WESTERN GAS

2259

June
1932

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"Sixty Wall Tower"—67-story monument to natural gas service, tallest structure in downtown New York—new home of Cities Service Company which serves half a million gas consumers in more than 450 towns throughout the nation.

A MONTHLY JOURNAL DEVOTED TO THE
WESTERN GAS & APPLIANCE INDUSTRIES

. . . . ONE LENGTH

OR A TRAIN LOAD

Every user of Republic Electric Weld Pipe—line pipe, casing or tubing—comments on its uniformity.

Start with the metal itself. It is homogeneous—fine open hearth steel rolled into plate or strip—free from brittleness and of uniform grain structure in the pipe wall and the weld.

It is round. Because the pipe is formed without application of heat no allowance need be made for contraction, resulting in a more nearly perfect cylinder than is possible by any other process.

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GENERAL OFFICES • • • YOUNGSTOWN, OHIO

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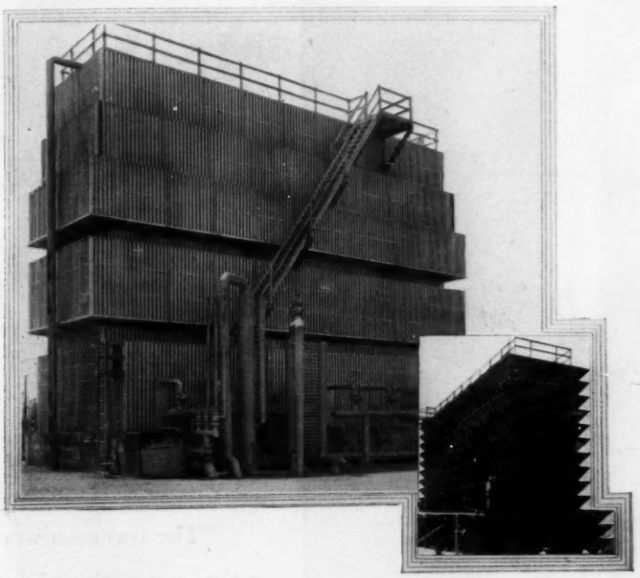
ELECTRIC WELD

LINE PIPE **CASING • TUBING**



Left: Unretouched photograph showing an actual installation of the new, improved FLUOR AERATOR-TYPE COOLING TOWER. Inset: Old-type, wide-louvre FLUOR Tower.

The Ultimate in Cooling Tower Efficiency

The FLUOR AERATOR-TYPE COOLING TOWER maintains its high efficiency rating under any and all operating or climatic conditions. Correctly engineered by an organization that has spent a lifetime building cooling towers throughout the world, the new, improved Vertical Aerator-Type Cooling Tower will add to your present operating schedule continuous, dependable service.

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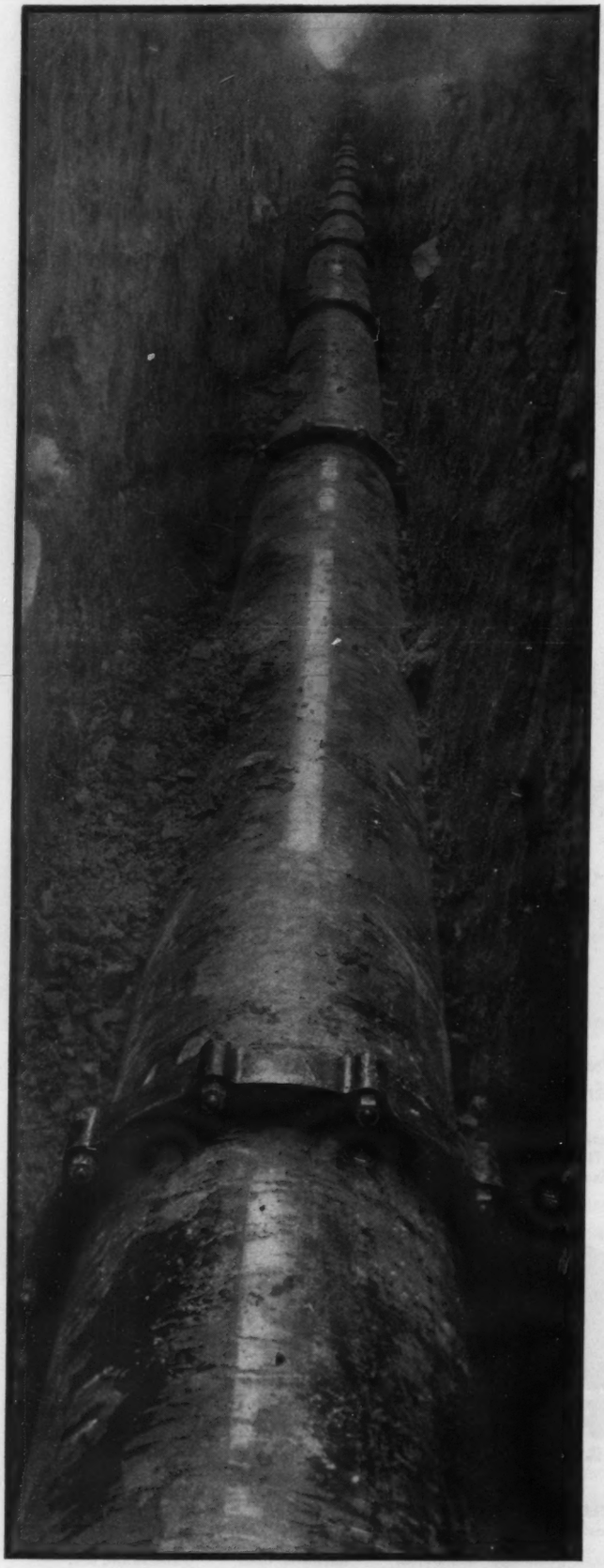

"... *I consider these* Mechanical Joints *as near to perfection as possible*"

About this recent installation of 16-inch *mechanical joint* cast iron pipe for a gas feeder main, a department official of the City of Duluth wrote one of our members as follows:

"The foremen were more than pleased with the ease with which the mechanical joint was assembled and I consider the joint to be as near perfection as possible. The ease of assembly facilitates and increases the speed of pipe laying while the tightness of the joints insures a dependable line. It is my honest opinion that one would have to go far to find a tighter, better-looking or easier joint to assemble."

The several *mechanical joints* made by the members of The Cast Iron Pipe Research Association are based on the time-tested "stuffing-box" principle. Many installations have demonstrated that these mechanical joints are *gas-tight* under medium and high pressures.

For further information write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 309 Peoples Gas Building, Chicago, Ill.

CAST IRON

Look for the "Q-check" symbol as shown above. It is the registered trademark of The Cast Iron Pipe Research Association.

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Write and tell us what you need. Electrolux Refrigerator Sales, Incorporated, Evansville, Ind.

ELECTROLUX

THE *Gas* REFRIGERATOR

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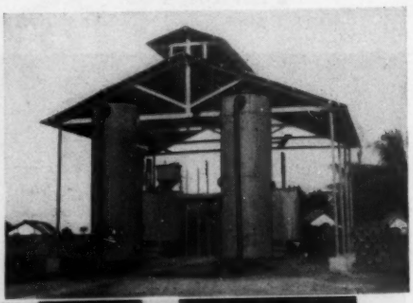
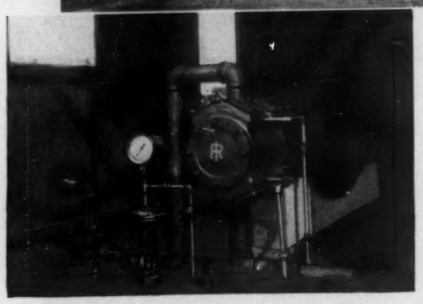
Completing her fourth trip this year, the Graf landed at this Brazil fueling station May 2. FISHER Type 227C control the levels in the cooling scrubbers of the hydrogen generating plant shown right above. FISHER Type 555 maintains a constant back pressure on the hydrogen compressor shown below. Although standing idle weeks at a time, FISHER Equipment has always functioned perfectly. The plant was installed by Carbide and Carbon Chemicals Corporation who supply pyrofax fuel gas and the chemicals for hydrogen generation.





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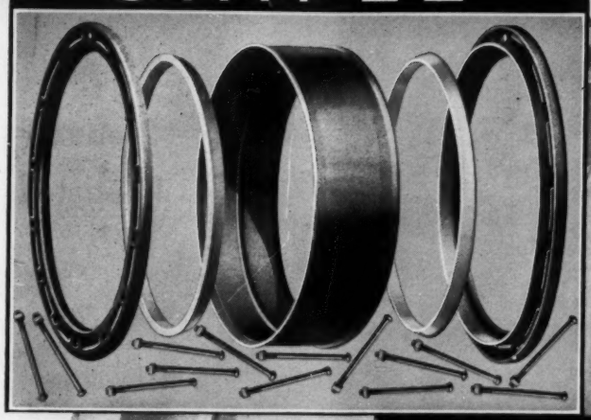

IT'S so easy to join two lengths of pipe with a Dresser Coupling . . . the job's done almost before you can describe it! A flange and a gasket slip over each pipe-end. The middle ring goes in between. Then these parts are moved together. The bolts are inserted and drawn up evenly all around. And there you are! You have a joint that will remain absolutely and permanently tight for the life of the pipe. Besides promoting rapid laying of permanent lines, Dresser Couplings are equally advantageous for temporary installations. They can be easily taken up and re-established elsewhere with practically no loss of material.

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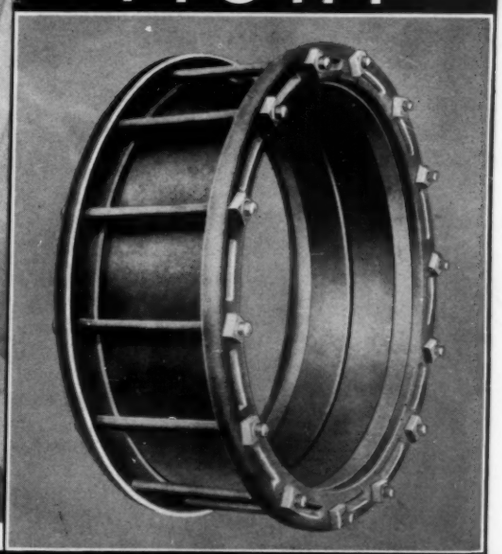
Wherever a big gas main or a long-distance line is laid in record time . . . or wherever the going is rough or the need for strong, flexible, durable joints is imperative—Dresser Couplings dominate. "Dressered" lines provide for all movements due to expansion, contraction, shifting ground, vibration and other strains. Maintenance is nil.

TIGHT



S. R. DRESSER MANUFACTURING CO.
BRADFORD, PA.

CANADA—Dresser Manufacturing Company, Ltd.
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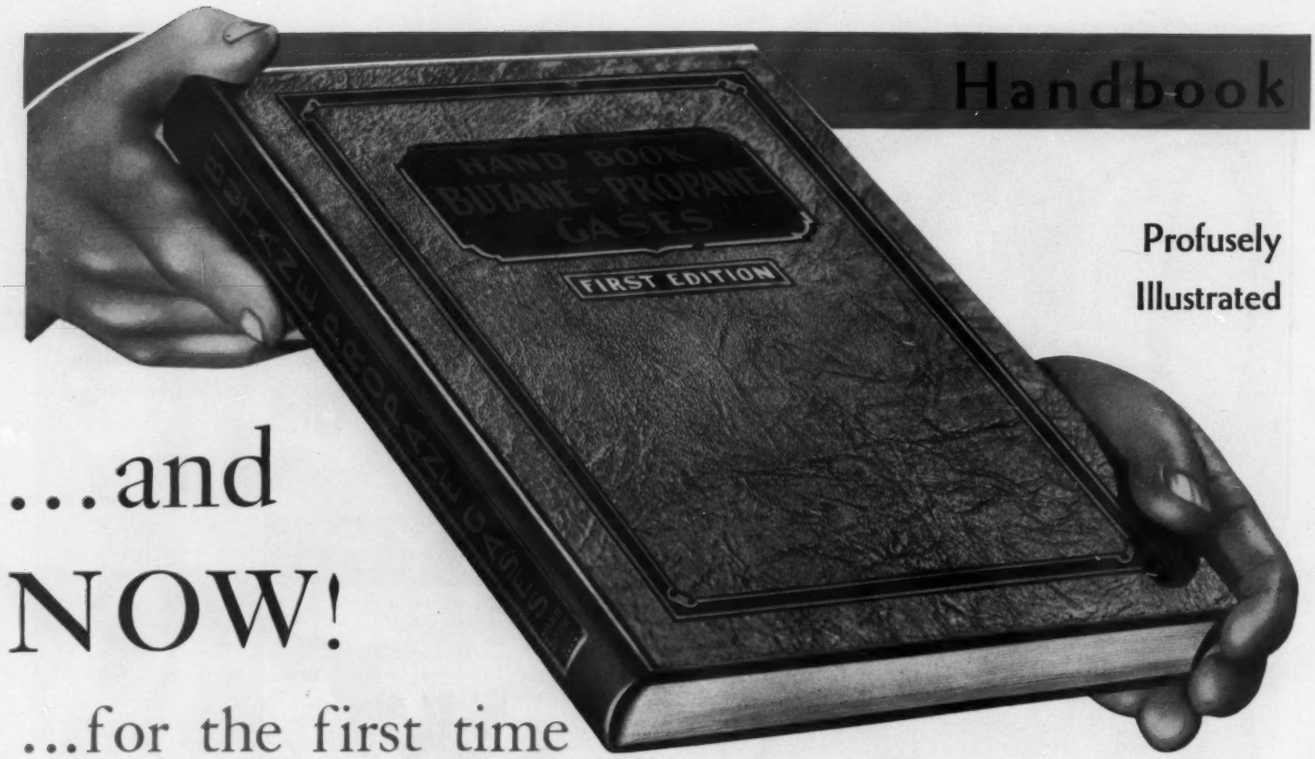
DRESSER COUPLINGS *DOMINATE!*



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THIS Handbook comes in response to a very definite need. A tremendous amount of development work has been accomplished for the liquefied petroleum gas industry in a brief space of time, with many companies participating. And to date there has been no one source to which the industry could go for information on all phases of the field. This is the mission of the *Handbook of Butane-Propane Gases*—consolidating and organizing all of these reference data under one cover.

Through the regular publication of "Butane-Propane News," a monthly feature of WESTERN GAS, the editors have established close contact with all branches of the liquefied gas industry—production, bottled gas and town plant distribution, gas enrichment—and to assure a high standard of technical excellence for the Handbook leading figures in the industry have extended their cooperation as contributors.

On the opposite page contents of the *Handbook of Butane-Propane Gases* are reviewed. No phase of the field is neglected, and every major subject heading is treated in detail, making the Handbook an outstanding reference work. Numerous tables, charts and illustrations add to its value.

Advance orders for the Handbook have poured in from all sections of the United States, and from several foreign countries, since the first announcement of its compilation —indicating again the need for this publication and the growing interest in butane-propane service. A limited printing makes it imperative that you place your order now (send no money). Use the coupon on the opposite page.

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# of BUTANE-PROPANE GASES

Look At These Features:

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(a) History: Highlights in development of bottled gas, central plant, industrial, and enrichment usage.

(b) Present and Potential Scope of the Industry: Statistics on marketed production; available supply; number of central plants, bottled gas distributors, producers; number of gas companies enriching; future field of expansion for bottled gas and central plant service, as well as other forms of liquid gas utilization.

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Vapor pressure curves and tables; tables of constants for hydro-carbon series; proportioning curves, etc. A section made up of basic reference data, with liberal use of curves and charts.

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Sources for liquefied petroleum gases; the natural gasoline extraction process; refinery gases; dehydration; mixes for gas enrichment, industrial plants, bottled gas, and town plant use under various temperature conditions.

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Presenting in convenient reference form pertinent regulations of the Bureau of Explosives, Underwriters' Laboratories, Compressed Gas Manufacturers Association, National Fire Protection Association; approved field practices for handling, storage, etc.; design of containers.

TRANSPORTATION:

By tank car, motor truck, pipe line, water; design of transportation equipment; traffic requirements; freight charges.

APPLIANCE UTILIZATION:

Appliance design and adjustment for operation on liquefied petroleum gases; combustion characteristics; fuel consumption of various types of appliances; appliance efficiencies on butane-propane, compared to other types of gas.

USE IN GAS MANUFACTURE:

Calculations in connection with use of propane and butane with manufactured gases; enrichment of manufactured gas transmitted under high pressure; use of propane and butane to meet peak loads; use of propane and butane as a substitute for gas oil for the carburetion of blue water gas; use of butane or propane for heating gas underfired coke ovens to reduce coke production.

CENTRAL PLANTS:

Design of plant and distribution system for both air-butane and undiluted vapor types; measurement and other operating problems; town survey; sales organization; rates and billing.

BOTTLED GAS DISTRIBUTION:

One-drum distribution; two-drum distribution; bulk stations; sales organization; rates and billing; utility co-operation on bottled gas sales; competitive fuels; combining central plant and bottled gas service; railway, marine and other special installations.

INDUSTRIAL USES:

Comparative costs of liquefied gases, coal, oil, manufactured and natural gas; description of plant lay-outs for industrial use of liquid gases; conversion problems in changing from other types of fuel to liquid gases; present and potential field for industrial use of these products; application of liquid gas to various industrial processes.

SPECIAL REFERENCE FEATURES:

(a) Directory of central plants, listing the towns served (with town population), date service began, type of service, type of distribution system.

(b) Directory of bottled gas distributors.

(c) Catalogue Section: Detailed specifications of equipment and appliances designed especially for this industry.

(d) Index: Cross-referenced by subjects and authors.

(e) Buyers' Guide: A commodity directory of appliances and equipment, with names and addresses of all manufacturers serving the industry.

....Send No Money—But Order Now! ....Use the Handy Coupon

THIS FIELD

WESTERN GAS .....193....

"Publishers," 124 West 4th Street
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(Name) *(Street Address)*

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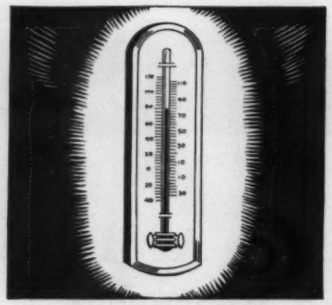
(Company) *(State)*

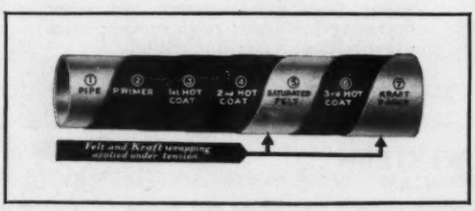


We make our own pipe-wrapping weather!

YOU can't depend on the weather man. When it rains or there is a heavy dew during the night, work in the field must stop or valuable time must be taken to dry the pipe thoroughly before field wrapping and coating can proceed. But the General Paint Corporation's Hill-Hubbell Process of mill-wrapped pipe completely guards against these irregularities.

The pipe is wrapped at the mill. Weather conditions are uniform. Great, skilfully designed machines apply coating and wrapping at a scientifically regulated temperature. The inexactness of human handling is eliminated. Labor costs are reduced. 5000 miles (over 15,000 carloads) of Hill-Hubbell mill-coated and wrapped pipe have been laid successfully by the largest gas and oil companies in the United States. These companies have found that Hill-Hubbell protected pipe not only eliminates the wastefulness and incompleteness of field-wrapped pipe, but actually increases the speed and lowers the expense of installation.

The Hill-Hubbell patented system of loading, protecting every joint, keeps pipe in perfect condition during unloading and installation.



For complete information write to any of the offices of the General Paint Corporation.

Plants for coating and wrapping by the Hill-Hubbell Process are located in the following cities for the production of the pipe manufacturers listed:

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Ambridge, Pa.

JONES & LAUGHLIN STEEL CORP.
Aliquippa, Pa.

NATIONAL TUBE COMPANY
Lorain, Ohio

REPUBLIC STEEL CORPORATION
Youngstown, Ohio

SPANG-CHALFANT & COMPANY
Ambridge, Pa.

YOUNGSTOWN SHEET & TUBE CO.
Indiana Harbor, Ind., and Youngstown, Ohio

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GENERAL PAINT

CORPORATION

New York, 11 Broadway.
Chicago, address Hill-Hubbell & Co., 105 West Adams Street.

Portland, Ore.; Seattle, Wash.; Houston, Texas; Spokane, Wash.

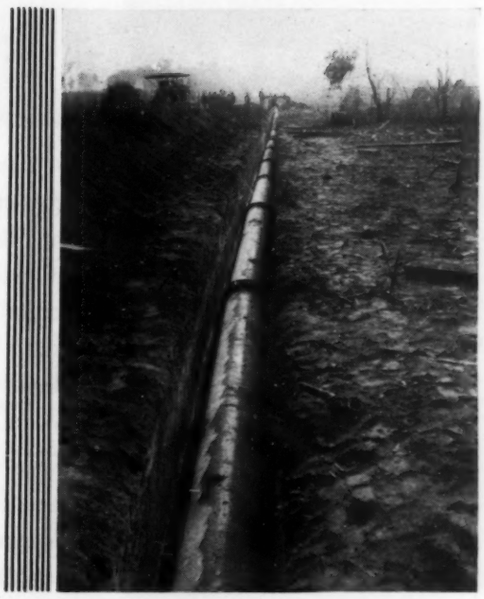
Tulsa, Oklahoma.
Los Angeles, 544 Mateo Street.
San Francisco, 160 Fremont St.

LONG LIFE··

DAYTON Couplings impart permanence to pipe line construction—permanence in installation for the life of the line—permanence in service by providing an everlastingly tight joint.

Descriptive literature free upon request

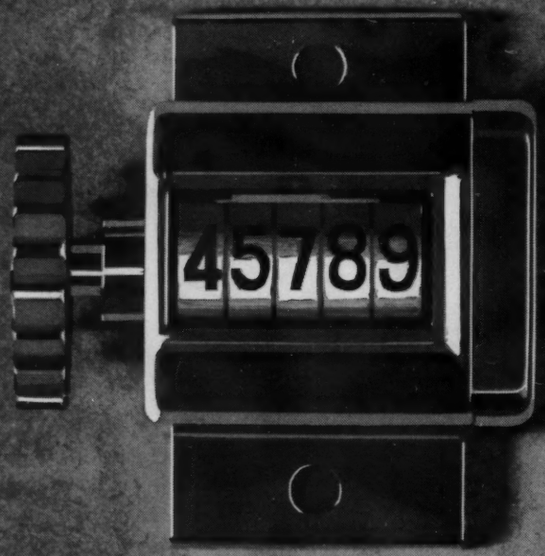
THE DAYTON PIPE COUPLING CO.
DAYTON, OHIO



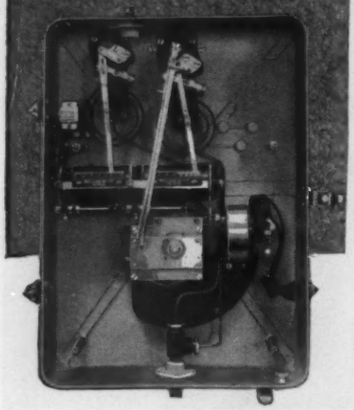
A Dayton-coupled line, flexible, yet permanently leak-proof.

DAYTON·ALL-STEEL COUPLINGS

DIRECT READING

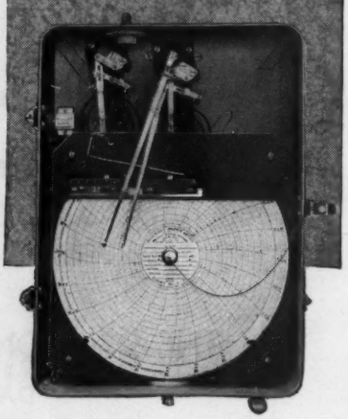


THE TOTAL METERED VOLUME computed automatically for variations in pressure and rate of flow IS ALWAYS VISIBLE ON THE COUNTER INDEX



The Integrating Orifice Meter embodies many unique features in gas measurement. The operation of this instrument is continuous—all functions being performed mechanically by special gearing without the use of clutches and reversible cams or levers. Thus the indicated total is always accurate.

The Metric Integrating Flowmeter operates on the same principle—giving a totalized indication of the quantity of liquids and gases at constant pressure.



Both instruments are adapted for measuring gas, air, oil, water and steam.
Bulletin E-16 gives a full description.

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WESTERN GAS

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THE PACIFIC COAST GAS ASSOCIATION

AND

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Contents for June, 1932

1760 Range Sales in 9 Days, by Cooperation 13
By H. E. Davidson

Water Vapor in Natural Gas 15
By C. H. M. Burnham

The KUH—Proposed Unit of Heat Measure 18
By George W. Cooper

Dehydrating Alfalfa by Gas Heat 21
By E. J. Lenz

Longitudinal Movement of Underground Pipe 22
By G. S. Beitler

Sales Promotion Digest 24

A Maintenance Service for Domestic Appliances 26
By C. R. Miller

PACIFIC COAST GAS ASSOCIATION 28

MEASUREMENT AND CONTROL 32

Determining Heating Value of Fuel Gases 32
By Guy Corfield

Training and Functions of a Field Meterman 34
By E. E. Stovall

BUTANE-PROPANE NEWS 38

Specifications for Commercial Propane and Butane 38
By T. W. Legatski

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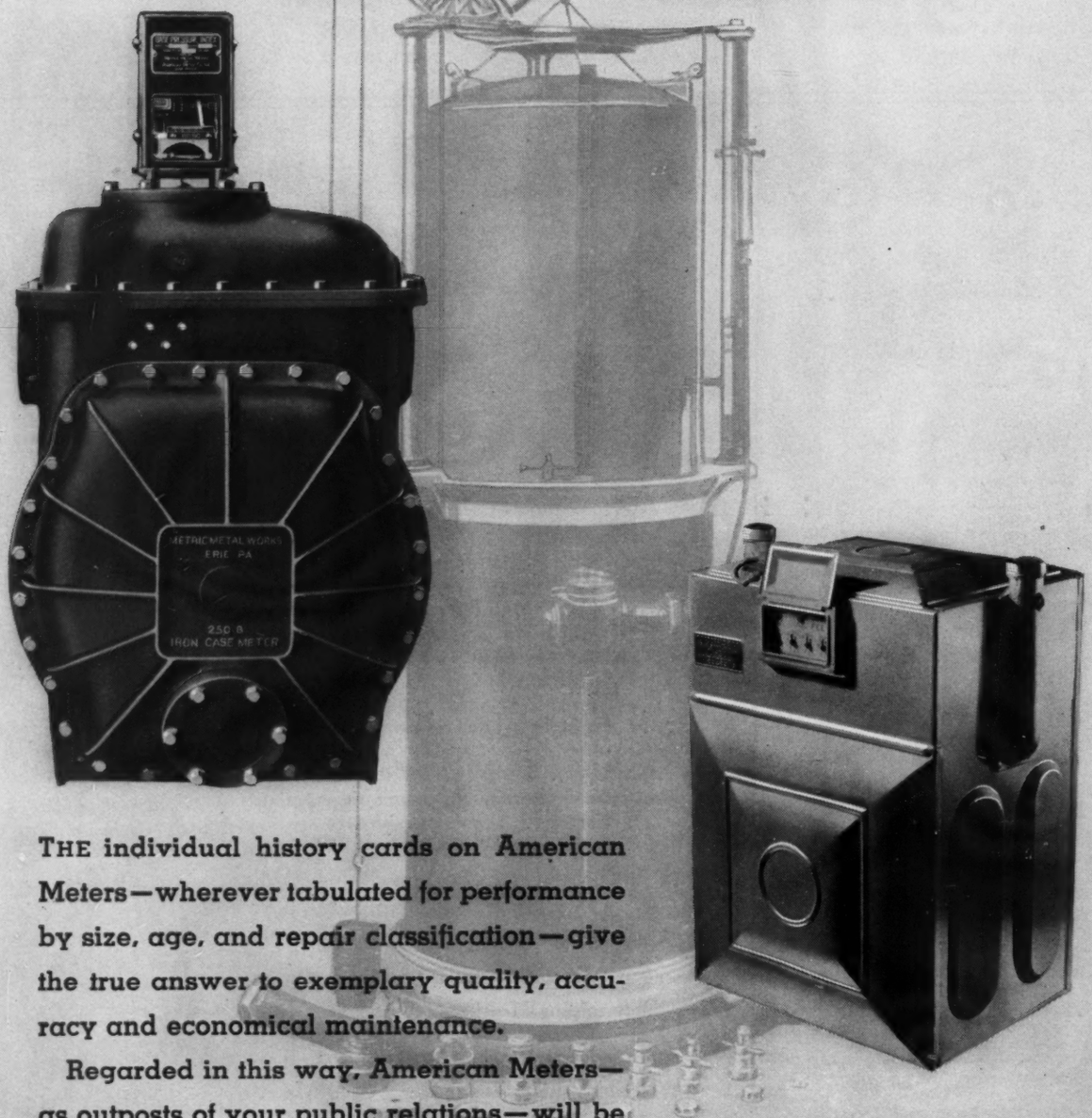
OUTPOSTS OF YOUR PUBLIC RELATIONS



THE individual history cards on American Meters—wherever tabulated for performance by size, age, and repair classification—give the true answer to exemplary quality, accuracy and economical maintenance.

Regarded in this way, American Meters—as outposts of your public relations—will be found a true asset to productive operations.

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ESTABLISHED 1836
GENERAL OFFICES : 105 W. 40TH STREET · NEW YORK, N.Y.

June, 1932

WESTERN GAS

Vol. VIII, No. 6

"Reg. U. S. Pat. Off."

A Monthly Journal of the Gas and Gas Appliance Industries in *Western America*

1760 Range Sales *in* 9 Days *by* Cooperative Efforts

By H. E. DAVIDSON

Superintendent of Appliance Sales
Southern California Gas Company

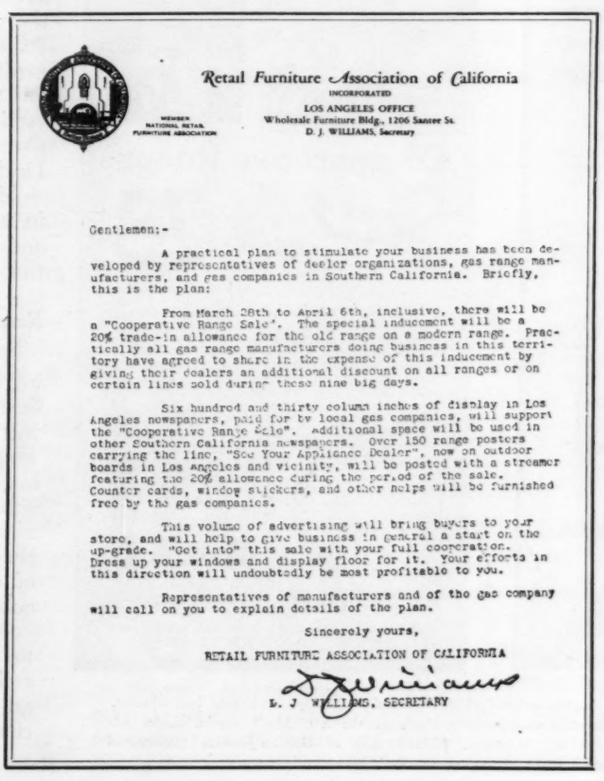
THEIR FIRST cooperative gas range campaign drew Southern California dealers, manufacturers and utilities into line for concerted selling. The letter below is an example of the support rendered by dealer associations.

EARLY this year it became apparent that much needed assistance could be given gas appliance merchandising in Southern California by making the joint advertising carried on by the Los Angeles Gas and Electric Corp., the Southern California Gas Co. and the Southern Counties Gas Co., which previously had been of a general promotional character, more direct and by featuring in it from time to time specific inducements which could be offered by all dealers handling particular classes of appliances. As the range business in the area was somewhat unsettled due to continued price cutting, it was decided to initiate such a plan with a cooperative effort in which all range dealers and manufacturers would be asked to participate, and which would favor the sale of quality merchandise.

With this purpose in mind, a committee consisting of two representatives of the range manufacturers, two of the gas utilities, the secretaries of the Southern California retail furniture and hardware associations and of the Los Angeles retail dry goods association was formed to work out the details and to organize the campaign.

After a number of meetings, at which the various divergent interests were gradually brought together, the committee decided on a nine-day sale running from March 28 to April 6 inclusive, during which a 20 per cent trade-in allowance for the old range would be offered on the sale of any insulated, full-enameled range with standard size oven and oven heat control, and selling for $89.50 or more. The purpose of this offer was of course to promote the sale of higher quality ranges, an aim which was given further support by a mutual agreement among the larger Los Angeles dealers not to mention in their advertising for the nine days any range selling for less than $69.50. The manufacturers shared the additional cost of allowing a 20 per cent trade-in instead of the usual 10 per cent by giving their dealers a percentage allowance based on the invoice price of all ranges sold during the sale.

Furniture and hardware dealers in the different cities were advised of the details of the sale by letters from the secretaries of their respective associations, and by personal calls from the representatives of the various range manufacturers and from utility dealer contact men. The enthus-



Retail Furniture Association of California
INCORPORATED
LOS ANGELES OFFICE
Wholesale Furniture Bldg., 1206 Santee St.
D. J. WILLIAMS, Secretary

MEMBER NATIONAL RETAIL FURNITURE ASSOCIATION

Gentlemen:-

A practical plan to stimulate your business has been developed by representatives of dealer organizations, gas range manufacturers, and gas companies in Southern California. Briefly, this is the plan:

From March 28th to April 6th, inclusive, there will be a "Cooperative Range Sale". The special inducement will be a 20% trade-in allowance for the old range on a modern range. Practically all gas range manufacturers doing business in this territory have agreed to share in the expense of this inducement by giving their dealers an additional discount on all ranges or on certain lines sold during these nine big days.

Six hundred and thirty column inches of display in Los Angeles newspapers, paid for by local gas companies, will support the "Cooperative Range Sale". Additional space will be used in other Southern California newspapers. Over 150 range posters carrying the line, "See Your Appliance Dealer", now on outdoor boards in Los Angeles and vicinity, will be posted with a streamer featuring the 20% allowance during the period of the sale. Counter cards, window stickers, and other helps will be furnished free by the gas companies.

This volume of advertising will bring buyers to your store, and will help to give business in general a start on the up-grade. "Get into" this sale with your full cooperation. Dress up your windows and display floor for it. Your efforts in this direction will undoubtedly be most profitable to you.

Representatives of manufacturers and of the gas company will call on you to explain details of the plan.

Sincerely yours,

RETAIL FURNITURE ASSOCIATION OF CALIFORNIA

D. J. Williams

D. J. WILLIAMS, SECRETARY

Parmalee-Dohrmann, one of many participating department stores which did a heavy business on gas ranges in Los Angeles during the campaign dates, devoted this window to the event.

9 BIG DAYS
MARCH 28 to APRIL 6
Announcement
Co-operative RANGE Sale
20% Allowance
for Your Old Range on a New and Modern Natural GAS Range
HAVE A NEW and modern natural gas range in your home! Your gas appliance dealer will allow you 20% for the range you now use—regardless of size or type—on the purchase of a new gas range. For nine days beginning March 28th, this opportunity is available through the active co-operation of leading dealers and manufacturers.
You will have that automatic oven heat control which makes baking consistently better; the insulated oven that saves fuel and keeps your kitchen cooler. Numerous lighting and broiler conveniences are awaiting your inspection. And beauty! The new natural gas ranges have cheerful colors in many combinations, smooth round corners, perfect designing. Such beauty is worth living with.
Visit your gas appliance dealer or gas company immediately. Remember the dates: March 28th to April 6th. Nine big days!
On the gas range you select, when you visit your gas appliance dealer, look for the Blue Star Seal of the American Gas Association Testing Laboratory.
SEE YOUR GAS APPLIANCE DEALER
SOUTHERN CALIFORNIA GAS COMPANY
LOS ANGELES GAS and ELECTRIC CORPORATION
SOUTHERN COUNTIES GAS COMPANY

GOODAN-JENKINS
724-726-728 South Broadway
This Latest Model WEDGEWOOD
MARCH 28 TO APRIL 6
Regular price $97.50
20% Allowance on your present stove $19.50
Co-operative Range Sale price $78
Turn in the stove you are now using, no matter how antiquated, and receive a 20 per cent allowance on this magnificent new 1932 Model Wedgewood. Its full porcelain, seamless surface is as easy to clean as a dish. Equipped with large size, 16-inch, fully insulated oven, heat control, porcelain linings throughout, pull-out-drawer broiler, large roll-out ball bearing utility drawers and Rutz lighter. Choice of green-and-ivory, all ivory or marble finish. It has the open cooking top with enameled grates and burners. Available with closed cooking top at slight extra cost.
See Goodan-Jenkins' complete showing of 1932 Models in these leading lines of Gas Ranges:
ESTATE
PREMIER
WEDGEWOOD
A-B
Large Pull-out Broiler
Large Roll-out Utility Drawer
This Special offer For 9 Days Only—March 28 to April 6
OPEN A GOODAN-JENKINS ACCOUNT

Gas companies headquartering in Los Angeles advertised the campaign jointly, and also individually. One of the introductory cooperative advertisements appears above at the left. Much special dealer advertising was run in impressive size, as the 3-column, 15-inch copy of Goodan-Jenkins (illustrated above at the right) exemplifies.

iastic support of manufacturers and association secretaries was of the greatest assistance throughout in organizing and promoting the sale. The active endorsement given the campaign by dealers associations is illustrated by a quotation from an article published in the April issue of "The Broadcaster," official bulletin of the Southern California Retail Hardware Association. Concluding an advance announcement of the campaign details, the article stated:

"We believe this event will be unequaled in the previous experience of selling better gas ranges, and is an opportunity both to develop public interest and an additional profit not only during the period of the campaign, but for some time to follow because of the interest it will create in the minds of the consuming public to buy a new gas range.

"Your secretary and officers hope that you will put forth real cooperative effort to tie in with this event as we believe that such an effort will be decidedly to your advantage."

Advertising

The campaign received strong advertising support, particularly from the larger dealers and the gas companies. The former utilized newspaper advertising almost exclusively, and supplemented it with attractive window displays. The three utilities together spent over $4,500 in specifically advertising the sale in the Los Angeles daily papers, and about $6,000 more on general range poster boards displayed four weeks in advance and during the sale; in addition they prepared and furnished the dealers with such material as counter cards, window streamers and circulars. All the newspaper and poster board advertisements prominently featured the phrase "See Your Gas Appliance Dealer."

Manufacturers assisted their dealers in arranging displays and advertising, and one used time on 13 radio stations to call attention to the event.

Results

The sale was most successful, resulting in the disposal of 1,760 ranges by all dealers during the nine days. Not only was this a far greater number than would ordinarily be sold in that time, but in addition the average sales price was much greater. Range sales prices of one large Los Angeles store were 50 per cent higher than usual, while those of one of the gas companies averaged over $118.

Before the sale most dealers had come to the realization that they were not making money in handling cheap ranges, all costs considered, but felt that they could not sell higher priced ones in the

(Continued on Page 48)

Water Vapor *in* Natural Gas

By C. H. M. BURNHAM

*Colorado-Wyoming Gas Company, Denver, Colorado**

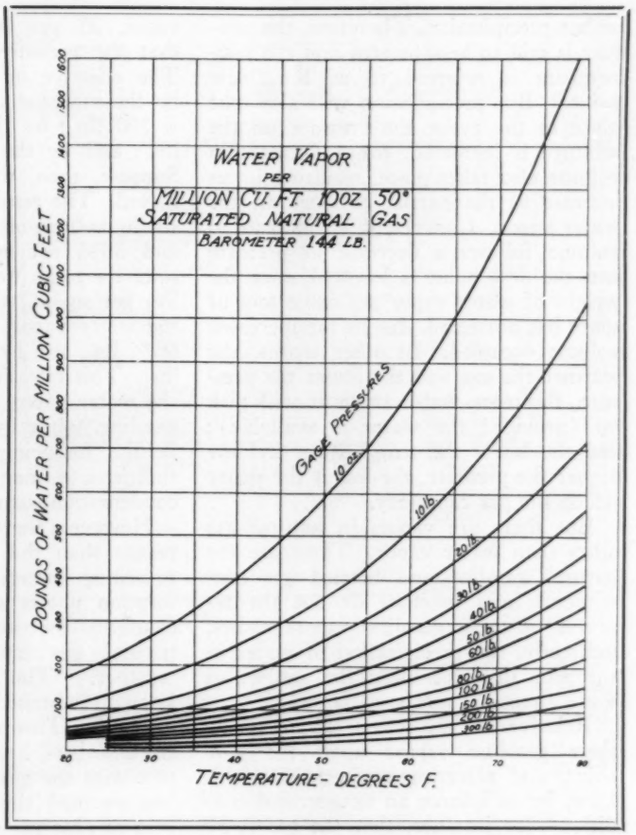


FIG. 1
(At Right)
Figs. 1, 2, 3, show the relations of pressure and temperature to the water-carrying capacity of natural gas.

MIXTURES of gases and vapors, especially those consisting of air and water vapor, have for some time been the subject of considerable study. The United States Weather Bureau has given this subject much attention and has prepared tables and empirical formulas for the ready solution of certain problems relative to the earth's atmosphere.

Any space is saturated when in contact with a liquid. Imagine an evacuated space over a liquid. The liquid will evaporate, due to the vapor tension or vapor pressure, until a point of equilibrium is reached wherein as much vapor is going back into liquid form as is being vaporized. The vapor will then be of constant density. The pressure exerted by the vapor upon the walls of the container is known as the vapor pressure and is dependent only upon the temperature, as is also the density. A decrease in temperature will be accompanied by some condensation. Therefore, the vapor is said to be saturated.

The above involves the law of partial pressures sometimes referred to as Dalton's Law, which states; "When two or more gases are present in a gaseous mixture of definite volume, the pressure of the gaseous mixture is equal to the sum of the pressures that would be exerted were each one present alone in the same volume at that temperature." It follows that the pressure exerted by each gas in the mixture is in proportion to the relative volume occupied by that particular gas or vapor, the sum of these pressures being equal to the total absolute pressure on the mixture.

If we consider a special case of Dalton's Law; viz., as applied to a mixture of a gas and a vapor—for instance, natural gas and water vapor, the above may be expressed as follows:

$$\frac{V_w}{V_m} = \frac{P_w}{P_m}$$

or

$$\frac{V_m - V_w}{V_m} = \frac{P_m - P_w}{P_m}$$

in which V_w is the partial volume occupied by the water vapor and V_m the actual volume of the mixture. (The term "actual" is used here and will be used hereinafter to distinguish the volumes referred to from equivalent volumes reduced to some standard condition of pressure and temperature. An actual cubic foot is a dimensional cubic foot.) P_w and P_m are the partial pressure on the vapor and the total pressure on the mixture, respectively.

Considering saturated solutions, since the pressure on the water vapor depends only upon the temperature of the gas-vapor mixture, it follows that the weight of water vapor per cubic foot also depends only on the temperature and not upon the presence of any large or small quantity of gas. One thousand actual cubic feet of space containing saturated natural gas at 200-lb. pressure contains the same quantity of water vapor as 1,000 cu.ft. at atmospheric pressure, the temperature being the same. If the 1,000 cu.ft. of gas at 200-lb. pressure be expanded to a pressure of 14.4 lb., the water carrying capacity is increased in proportion; and, conversely, if 1,000 cu. ft. of saturated gas at atmospheric pressure be compressed to 200-lb. gauge, the weight of the water vapor must decrease.

It has long been known that natural gas contains varying amounts of water vapor, and since the inception of the natural gas industry it has been necessary to install pockets in the pipe lines, commonly referred to as drips, in which the condensation may collect to be perodically drained off.

While the presence of water vapor in natural gas *as a vapor* is not undesirable except, possibly, as a diluent; however, once it condenses, trouble and losses of no inconsiderable extent result to the gas companies. The three principal causes are: first, the freezing of this water in the pipe lines and regulators, bringing about serious interruptions of service; second, in the removal of this condensate from the drips large quantities of gas are blown into the atmosphere yearly; and, third, the reduction of line capacity due to accumulations of water in low places not provided with drips constitutes an item of no little expense.

Natural gas when in the presence of water literally "absorbs" water vapor, the quantity taken up depending upon the volume and temperature. After a condition of equilibrium or constant density is reached, any decrease in temperature will be accompanied by more

*Presented at the Annual Convention of the Natural Gas Department, American Gas Association, Tulsa, Okla., May 9-11, 1932.

or less precipitation. Therefore, the mixture is said to be saturated and the temperature is referred to as the "dew point." But precipitation will also take place in the event the pressure on the mixture is increased, for a decrease in volume also takes place, resulting in an increase of the partial pressure on the water vapor. Conversely, an increase in volume follows a decrease in pressure and the dew point is lowered since the weight of water vapor per cubic foot of space has decreased, due to the increased volume occupied. In other words, the warmer the gas and the lower the pressure, the more water vapor it will pick up (provided the water is available); and the lower the temperature and the higher the pressure, the less is the water which the gas can carry.

But there are vapors in natural gas other than water vapor. These are the natural gasoline and bottled gas constituents, and whether or not the removal of these gasoline vapors causes, indirectly, the precipitation of water in the pipe lines has been the subject of some discussion and speculation.

Relative to the effect of removing these gasoline vapors upon the dew point, and referring again to Dalton's Law, let us assume an exaggerated condition—for instance, that the gas is 50 per cent methane, 25 per cent gasoline vapor, 25 per cent water vapor, and that the pressure is 200 lbs. absolute. The effective or true pressure exerted by the methane, according to this law, is 100 lbs.; by the gasoline vapors, 50 lbs.; and by the water vapor, 50 lbs. Suppose, then, that the gasoline is removed. The resulting mixture will consist by volume of 66⅔ per cent methane and 33⅓ per cent water vapor, and since the total pressure still remains 200 lbs. per sq. in., the pressure exerted by the water vapor will have increased to 66⅔ lbs., and by the methane to 133⅓ lbs. This effective pressure increase on the water vapor due to the removal of gasoline, while by no means as great as in the foregoing assumed example, is sufficient in many cases to cause some condensation, usually in the absorbers.

However, there is probably a greater reason than the one mentioned in the preceding paragraph why gasoline absorption plants are looked upon suspiciously as the cause of freeze-ups in the natural gas main lines during cold weather. The absorbing oil, it is known, contains water in appreciable quantities. This oil is circulated through the absorbers, brought intimately in contact with the gas, and both are more or less warmed through the effect of the heat of absorption. If the gas does not already contain all the water vapor it can carry, quite likely it will very soon reach that condition, the amount of water vapor depending upon the pressure and temperature in the absorbers.

So it is seen that there exists in the gasoline absorption plant two opposing conditions; first, the removal of gasoline tends to precipitate water; and, second, being literally washed with water, the gas absorbs water vapor until saturated. Regardless of the source of the water there is one point that one can be assured of; viz., at the pressure and temperature at which it leaves the absorbers, the gas, generally speaking, is saturated with water vapor.

To show these relations of pressure and temperature to the water-carrying capacity of natural gas, three sets of curves have been prepared.

Referring to Figs. 1 and 2, the ordinates represent the pounds of water in vapor form in one-million cu.ft. of natural gas, (at 10-oz. pressure and 50° F.,) corresponding to the gauge pressure marked on each curve, and to the temperature in degrees F. on the abscissa. By use of these saturation curves, the amount of water in a saturated gas under given conditions can be quickly approximated. For instance, at 10, 20, 30, 40, 50, 100, 200, 300, 400, 500, 600, 700 and 800 lbs. pressure and 70°F., a million cu. ft. of 10 oz.—50°

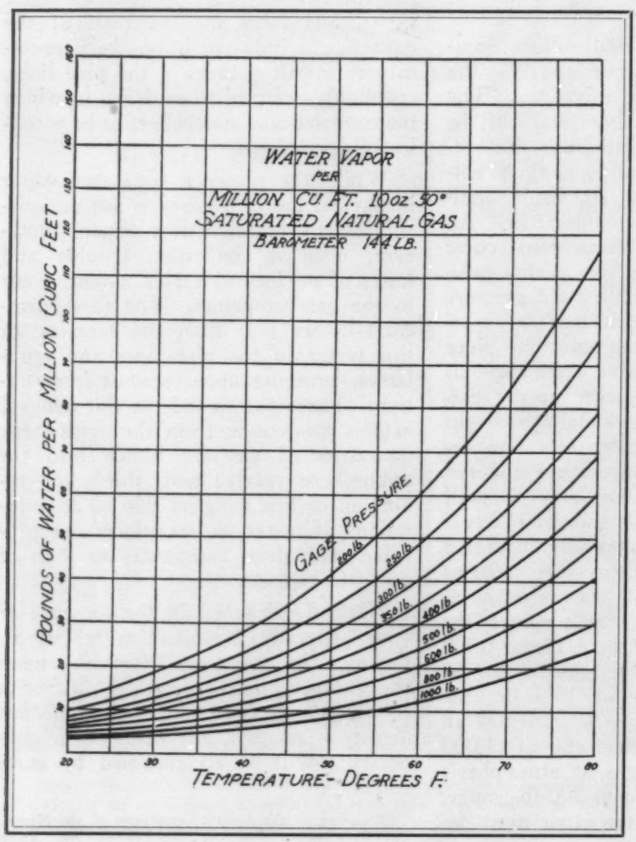


Fig. 2

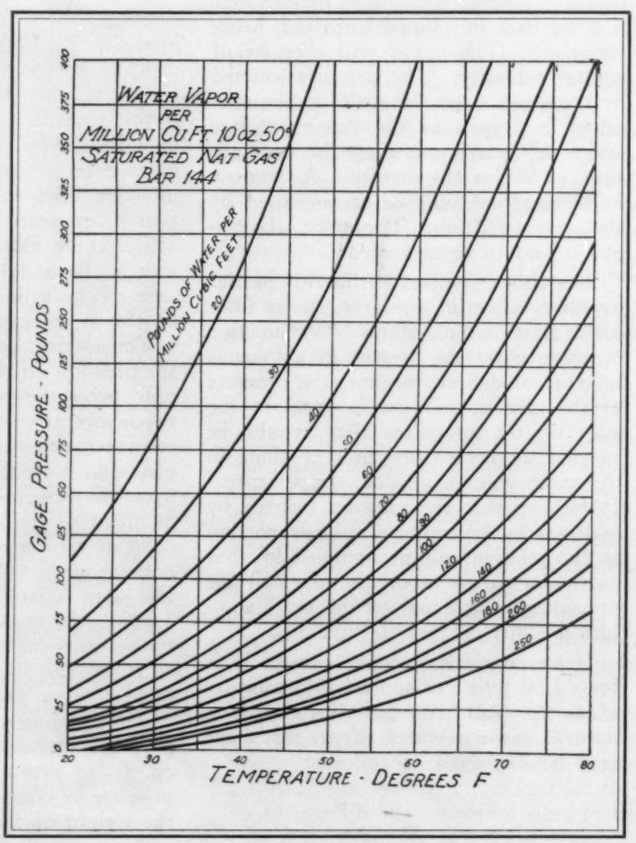


Fig. 3

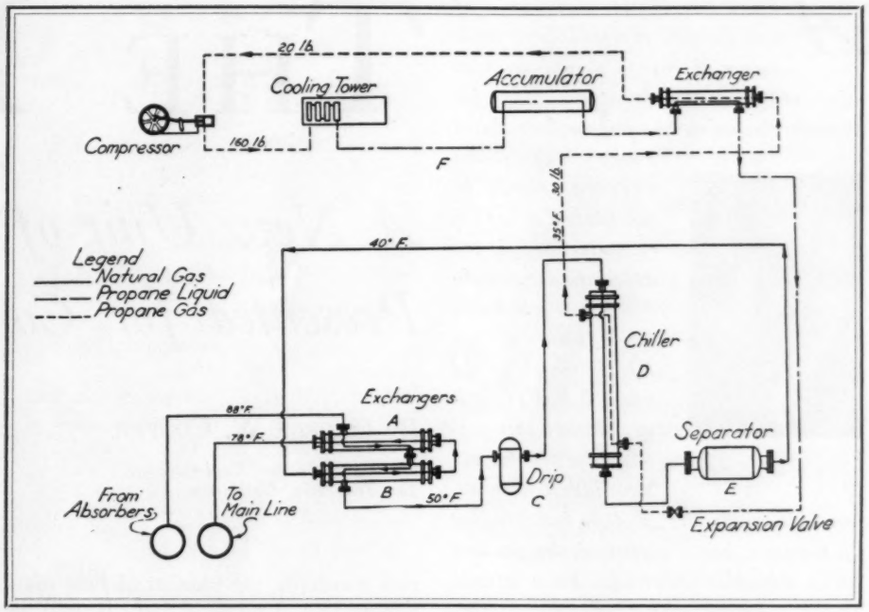


FIG. 4
(At Right)

Flow diagram of the refrigeration plant at Fritch, Texas, which dehydrates gas at the outlet of the Fritch natural gasoline plant by lowering temperatures. The gas is then warmed in heat exchangers before transmission to Chicago and other points on the Natural Gas Pipe Line Co. of America system.

natural gas contains 733, 520, 403, 329, 278, 156, 83, 57, 42, 35, 29, 25 and 22 lbs. of water vapor, respectively.

At 40, 50, 60, 70 and 80° F. and 200-lb. pressure, the respective water contents are 28, 41, 59, 83 and 116 lbs. per million cu.ft.

A general inspection of the curve on Fig. 1 reveals a point of interest; viz. that at low temperatures and high pressures a change either in pressure or temperature is accompanied by a relatively small change in the water content. On the other hand, at low pressures and high temperatures a small change either in pressure or temperature brings about a change in the water content that is quite appreciable.

Fig. 3 has similar information, but is plotted in a different manner, the ordinates representing the total gauge pressure on the gas above 14.4 lbs. absolute pressure.

The curves of Fig. 3 contain the particular information in which those concerned with the transmission of gas in pipe lines are interested; viz., it shows for a given water vapor content, the value to which the pressure on the gas must drop in order to avoid the condensation of water vapor accompanying a reduction in the temperature. Let us assume that the gas leaves the absorbers saturated at 250-lb. pressure, 80° F.; by reference either to Figs. 1 or 3 the water-vapor content is found to be 94 lbs. per million cu.ft. Select any point on the transmission system and measure the temperature of this gas. If the temperature as determined has decreased to 70° F., the pressure must have decreased to 179-lb. gauge ~~or~~ condensation will occur. In a similar manner, the pressure decrease which must accompany a fall in temperature to prevent the condensation of water vapor in the pipe line is determined to suit any given condition.

However, if, in order to care for the variations in demand on a gas transportation system, the storage capacity of the lines is to be used at all, it will not be found feasible to maintain a fixed pressure gradient between main line compressor stations, or between compressor stations and the markets. Line pack during off-peak hours will, therefore, cause condensation—the other factors, temperature, and relative humidity, being favorable.

Location of drips

It follows that the designer of gas lines always has been faced with the problem as to the number and location of drips. The question "how many drips and where?" has confronted the natural gas engineer since the beginning of this industry. The installation of too few drips may cause serious difficulties, while to equip every low place in a line of any length would be prohibitive.

From the foregoing it is apparent that the lower the temperature and the higher the pressure of the gas as it leaves the well, the compressing station, or the gasoline plant, the less is its water carrying capacity; it follows, less will be the tendency for condensation to occur.

Many operators have found, for the above reasons, that by heavily dripping the sections of their pipe line systems nearest the field, and for the first few miles on the discharge of each compressor station, a practical solution of this problem is sometimes obtained. However, it is not an uncommon occurrence to find that water has accumulated in the least expected places.

How best to take the guess work out of the location and number of drips was a problem of no little consequence faced by the builders of the Chicago line. The length of this line is unusual. It extends from an area of moderate temperature into one of low temperature. The investment in this line was so great that no capacity could be sacrificed to inadequate dripping. The answer to their problem is the refrigeration plant in operation today at Fritch, Texas.

This dehydration plant (see Fig. 4) consists of equipment to lower the temperature of the gas on the outlet of Fritch gasoline plant to as low a temperature as it may reasonably be expected to reach on its journey to Chicago. At this reduced temperature separators remove the precipitated water and any mist that may be in suspension. The gas is then warmed in heat exchangers and sent "on its way."

Propane is the refrigerant—a supply of which is available at the nearby gasoline plant.

Referring to Fig. 4. The gas from the gasoline plant absorbers passes through heat exchangers A and B; thence through drip C. Any water that condenses in the exchangers is removed from the gas in drip C. Leaving drip C, the gas enters chiller D at the top, passing downward and out the bottom into separator E, where the suspended water in the form of mist is "knocked down." The gas is then returned through the exchangers to the main line.

The propane used in the chiller is recycled in equipment F.

As to the success of this installation, it may be said that the Chicago line, for one, is notoriously dry.

The foregoing discussion has dealt with the subject matter purely from a pipe line transportation standpoint. In the following discussion it will be the purpose of this paper to treat the subject from the distribution engineer's point of view; i.e., as to the effect the presence or absence of water vapor in

(Continued on Page 46)

THE K-U-H

A New Unit of Heat Measure Is Presented for Consideration

ADOPTION of some unit of heat directly comparable to other forms of energy would seem to offer self-evident advantages. In his present discussion the author introduces a unit which equates thermal energy to mechanical energy, recommending it for application to established gas schedules. In behalf of the KUH, which would equal 1 KWH, it is urged that this proposed unit would have identical meaning in any locality, and be independent of pressure, heat content of the gas and other variables involved. Such a unit, says the author, would offer the psychological advantages of enabling comparisons between electric rates in cents as against gas rates in mills.

George W. Cooper

While "Western Gas" holds no brief for this particular unit, we welcome the opportunity of publishing Mr. Cooper's constructive discussion of an important theme.—EDITOR.

By GEORGE W. COOPER

Phillips & Cooper, Engineers
San Francisco, California

THE purpose of this discussion is to present for consideration to the gas industry, in particular, and the engineering world in general, a new unit of heat measure to replace the obsolete and cumbersome B.t.u.

For the past century the gas industry has labored under the handicap of selling its commodity on a basis not only incomprehensible to the consuming public but under certain conditions meaningless to its own trained personnel. As an example of this, a quoted gas rate in some New England states may be infinitely higher or lower, on an actually comparable base, than a similar rate quoted in one of the southwestern states, even though the "rate per thousand" may be identical. The eastern rate may be based on a 450 B.t.u. gas measured under a 6-inch water column, while the western rate may be based on an 1100 B.t.u. gas metered at 4 ounces pressure. As a numerical comparison of the divergence that may exist, assume that the following standards are in effect in the two localities.

Eastern Rate—1.00 per M ft.
450 B.t.u., at 6 inches water.
Western Rate—$1.00 per M ft.
1100 B.t.u., at 4 ounces.

By reducing these quotations to the only common factor possessed by the two standards, the number of heat units purchasable for one dollar, it will be found that the heat supplied under the western rate is nearly three times that furnished by the eastern utility. Yet, in either case, a casual inquiry of the gas schedules would elicit the information that the gas rates were, "one dollar per thousand", even from utility employees and executives. Thus, unless several dependent factors are enumerated in conjunction with a gas rate quotation, the absolute price of the commodity is not expressed even to the technically trained expert. Under these conditions it is utterly absurd to imagine that the layman, the housewife, or the ordinary consumer can even suspect the true significance of established gas rates, let alone render an intelligent decision on the economics of their personal demands.

Until recently this situation was immaterial, as the gas utilities were selling service and convenience with their commodity rather than economy. However, with the introduction and improvement of the incandescent electric lamp, gas was hopelessly eliminated from the lighting field and relegated to the kitchen and basement in the home and boiler room in the industrial plant. With new designs and economic modifications overcoming certain inherent disadvantages of electric appliances, the gas industry again finds itself confronted with the problem of its sister utility, the electric industry, making appreciable inroads on its heretofore inviolate domain, the domestic kitchen.

Electric energy and gas are in competition in virtually only one form, *heat,* with certain advantages accruing to both commodities. However, in this struggle for supremacy, a tremendous advantage has always rested with the electric utilities in their very happy choice of commercial units of measure in the early days of the industry. Peculiar as it may seem, this advantage is based on the electric utilities' most vulnerable point of attack, that of unit operating cost comparison with gas, and to turn this subtle advantage in the opposite direction requires but a revision in the gas unit. The dominant advantages of the electric utilities' units are: in the first place they are absolute, that is, not dependent on any measured value of gravity, specific heat or other "variable constants", and are of equal value the world over. In the next place, the chosen unit of the kilowatt-hour instead of, for instance, the megawatt-hour or the milliwatt hour keeps the figures normally encountered within the range of human understanding on both the rates and quantities involved, while the present real unit of gas measurement (the B.t.u.) if employed commercially, would require more places in front of and behind the decimal point than reason could grasp. It is equally as absurd to say that the cubic foot is a measure of gas as to say that the ampere is a measure of electric power. In one case the pressure and the heat content must be known and in the other the voltage and the power-factor, before any knowledge is gained as to the energy in question.

Of greater commercial importance than any of the above, however, is the psychological effect on the consumer of comparing gas rates in dollars against electric rates in cents. The fact that the gas unit (the M.c.f.) may be several hundred times the size of the electric unit (the KWH) is not immediately grasped by the intelligence, and, as demonstrated the comprehensive analysis is subject to considerable complication. The merchantile establishments have for years recognized this fundamental psychic reaction of the human mind readily accepting an emphasized item and have capitalized it by standardizing on such peculiar price markings as $9.95—$99.50, et cetera. The 5 to 50-cent loss incurred by this slight drop below the

obvious "round figure" quotation has been found to overcome sales resistance and stimulate trade to an extent not equaled by several hundred times a like amount invested in display or circulated advertising.

One of the peculiar anomalies of this situation with respect to gas rates is the simplicity of the solution and that neither the utilities, from purely selfish motives, nor the consuming public have installed or demanded a simplified and comprehensible rate structure. A few isolated attempts by some of the utilities, in the introduction of the "therm" and other like units are steps in the right direction but have, regrettably, fallen short of satisfying the major condition, that of reducing gas quotations to an absolute and constant base comparable with other fuels. In the first place these units are hybrids without rhyme or reason, and, in the second place they tend only to make the "confusion more confounding" by flooding the field of measurement with a series of independent and unrelated units.

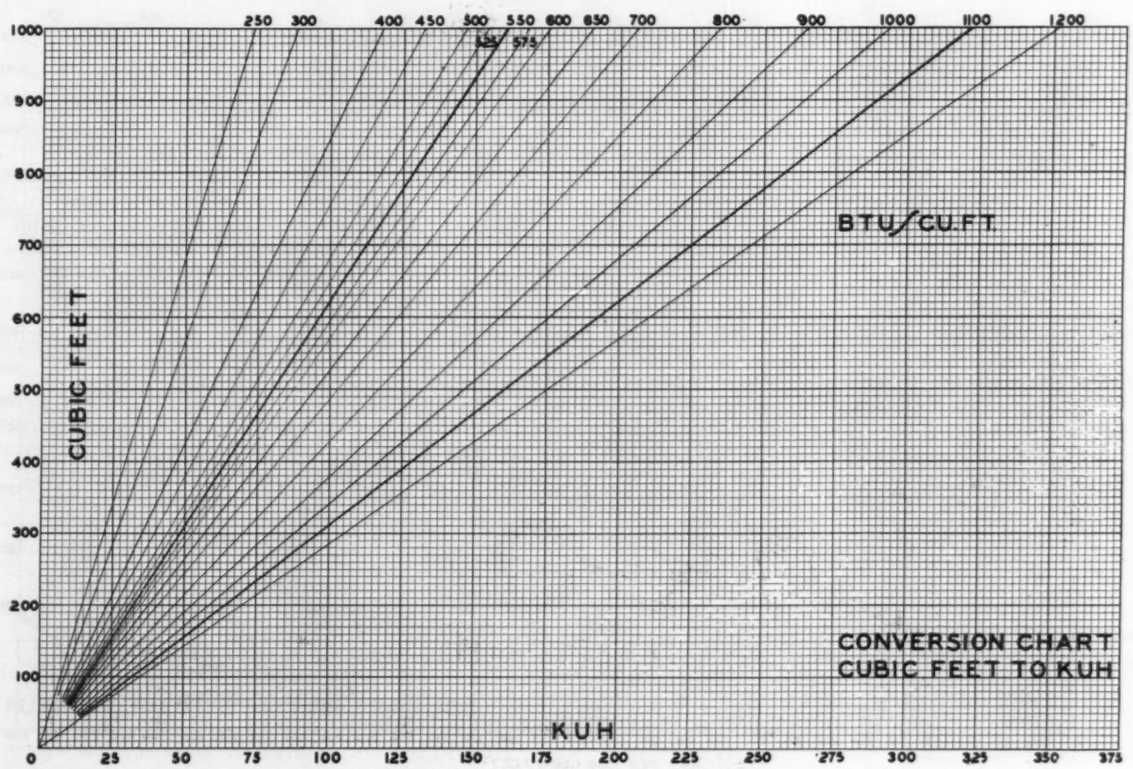
The remainder of this discussion will consider only one phase of this subject, that of the reduction of gas rates to a scientific basis that has a definite and immutable value under all circumstances. However, in as much as the unit to be established herein will be equally applicable to other fields of heat measurement it may be hoped that eventually the liquid and solid fuels might be calibrated in the same unit and thus eliminate the last trace of the medieval theory that heat is a "mysterious juice" that emanates from physical bodies when work is performed on them.

Now for the purpose involved in this discussion, the question may arise as to whether heat is a form of energy or energy a form of heat. Either point of view may be held but it is more practicable and comprehensible to assume that "energy" is the more inclusive term and "heat" the subdivision.

In order that a thorough understanding of the relationship obtaining between heat and other forms of energy may be had and that the proposed unit may be erected on the most basic foundation, it will be necessary to review certain fundamental definitions and units entailed in energy calculations. In the first place a choice must be made as to the basic units upon which the structure of the new unit will be reared. There appears to be no valid reason why any system of notation other than the so-called C.G.S. should be selected or established as it is the basis of all scientific and electrical measurements and is the recognized legal standard of nearly every civilized nation of the world. As the name implies the C.G.S. system of units is based on the selection of the Centimeter (1/100th part of a meter) as the unit of distance, the Gram as the unit of mass and the Second as the unit of time. All other systems of notation

CONVERSION FACTORS

I KUH equals . 1 Kilowatt-hour
1 KUH equals . 1000 Watt-hours
1 KUH equals . . . 3412 B.t.u.'s
1 KUH equals . . . . . .
. . . . 860 Calories (Large)
I KUH equals . 3,600,000 Joules
1 KUH equals . . . . . .
. . . . . 367,076 Kg.-Meters
1 KUH equals . . . . . .
. . . . 2,654,200 Foot-pounds
1 KUH equals . 1.34 H.P.-hours
1 KUH equals . . . . . .
. . . 3.51 lbs. water evaporated from and at 212°F.
1 KUH equals . . . . . .
22.75 lbs. water raised from 62°F. to 212°F.
1 Bbl. Oil (18,000 B.t.u.) equals 1760 KUH (Approx.)
1 lb. Coal (14,000 B.t.u.) equals 4 KUH (Approx.)
1 Boiler HPH equals 9.812 KUH
6.25 Cu. Ft. 550 B.t.u. gas equals 1 KUH
1 KUH per hour equals 1 KU (coined term).
1 KUH equals 1.3596 Metric HPH.



can be reduced to these three elemental quantities.

By definition (and for no other reason) the present unit of heat is the amount of heat required to raise a certain quantity of water a certain number of degrees in temperature. (The B.t.u. —British thermal unit—is the 1/180th part of the heat required to raise the temperature of one pound of pure water from freezing point (32°F.) to the boiling point (212°F.) under standard conditions. The Calorie (small) is the amount of heat required to raise one gram of water one Centigrade degree in temperature under the same conditions.)

Joule's experiments, resulting in the establishment of the so-called Joule's Equivalent (Mechanical Equivalent of Heat) backed by subsequent investigations and measurements, clearly define the relationship of heat to energy. The numerical value of this ratio is generally accepted at 777.5 foot-pounds per B.t.u. in the English system. The exact accuracy of this figure in the fourth or fifth place is subject to question but that some absolute ratio exists is incontestible and merely the mechanical difficulties encountered in its measurement render the results hazy behind the decimal.

Knowing that heat is a form of energy there appears to be no valid reason why its units should not be expressed in terms of energy rather than placed in a special category of their own, or if such a category is to be established the ralationship should be simple, definite and expressive. Under the definition given above the B.t.u. and Calorie are exact quantities but ones that have not been reduced to their lowest terms or to a common denominator with respect to other forms of energy. As defined, the unit of heat is "the amount of heat required to raise one unit of water one unit in temperature under certain conditions". By the mere substitution of one term for an interchangeable equivalent in the above definition, it is possible to transfer the entire science of calorimetry from its present dogmatic scale to the absolute units of the C.G.S. system; that is define the unit of heat as "the amount of thermal energy required to raise the temperature of one unit of water one degree under standard conditions. Now the adjective "thermal" in the above is entirely superfluous as it merely qualifies the type of energy, and, the introduction of water, temperature, et cetera, into the definition is for the sole purpose of imposing limits on the numerical value of the unit established by this definition. Any other set of limits would be equally satisfactory, in fact, the purpose of this discussion is to replace these limits with others possessing more merit. Under the definition just given, it is possible to proceed one step farther and define an abstract unit of heat as "any convenient number of energy units that may be selected" without reference to water, temperature, chemical purity, specific heat, pressure or other limiting characteristics.

With the acceptance of this definition of an abstract unit the problem now resolves itself into the determination of the quantity of energy units that shall comprise one heat unit. In order to establish this ratio, it will be necessary to revert to the three fundamental C.G.S. units the centimeter, the gram and the second.

Force: By definition one *Dyne is* the unit of force and is the amount of force required to accelerate one gram of mass one centimeter per second per second.

Work : By definition one *Erg* is the unit of work and is the amount of work accomplished by one dyne acting through one centimeter. The erg is much too small to be of practical value so has been replaced by a unit composed of ten million (10,000,000) ergs; the *Joule.*

Power: By definition the *Watt* is the unit of power and is the expenditure of work at the rate of one Joule per second.

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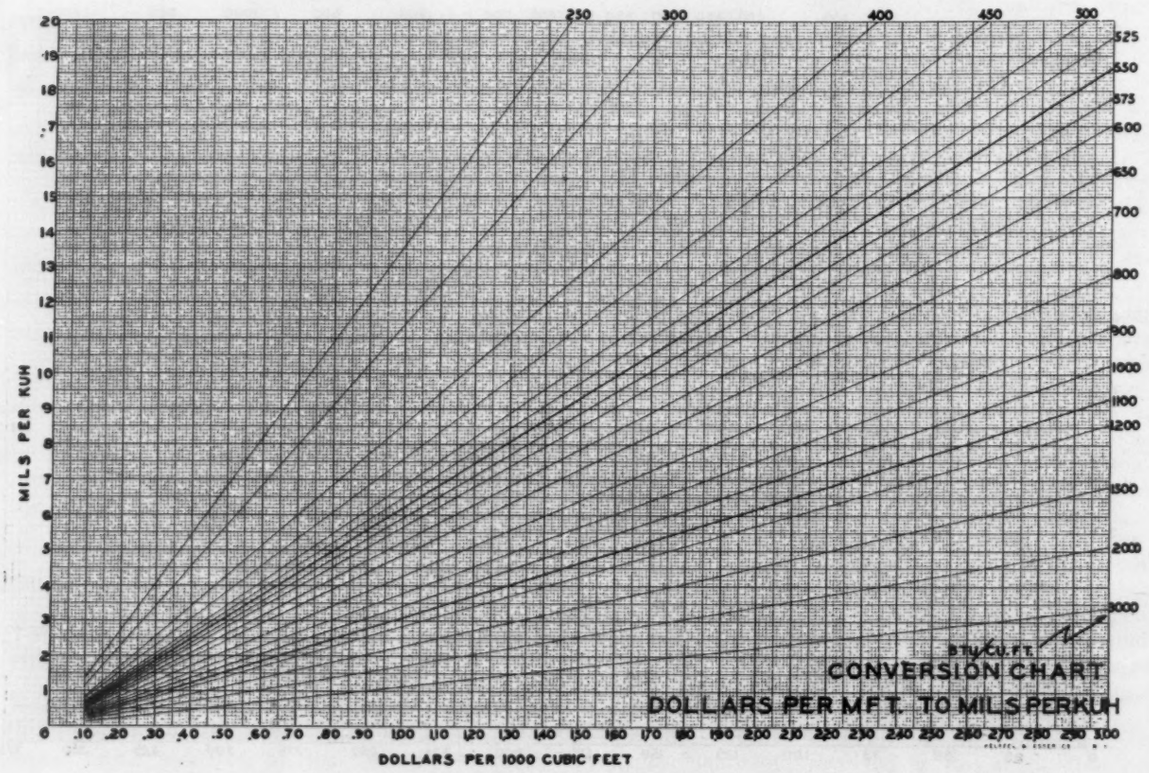
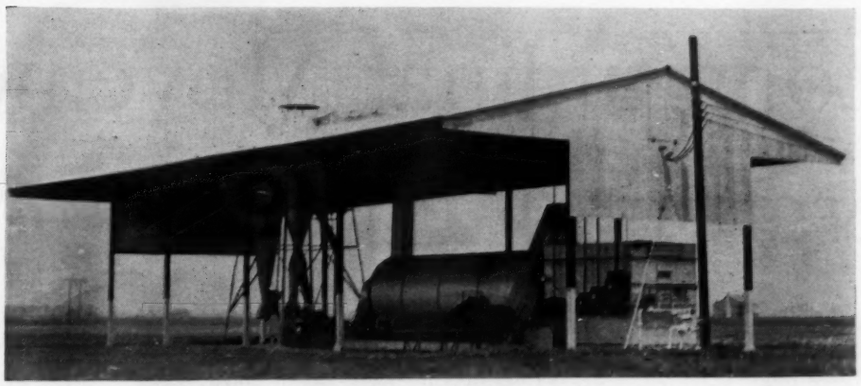




General view of alfalfa drying plant on Mississippi Power & Light Co. lines.

Dehydrating Alfalfa: New Use *for* Natural Gas *in* Mississippi

By E. J. LENZ

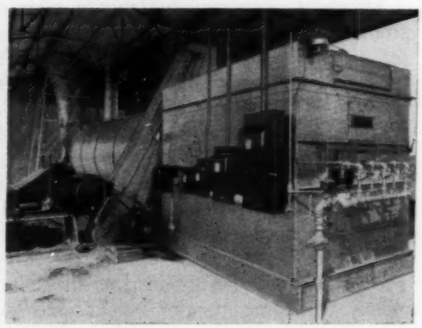
Division Manager
Mississippi Power & Light Company

WHILE the Mississippi Delta has gained just renown for its production of long staple cotton, a secondary industry of considerable importance is that of alfalfa growing, and as a result of recent developments in the application of natural gas fuel this industry gives promise of rapid progress.

Alfalfa has been grown successfully in the Delta section for over 30 years, the soil having all the natural properties necessary to produce an abundant and luxurious growth without the aid of fertilizer or irrigation, and being capable of producing eight tons of cured hay per acre per season. Alfalfa growers in the Delta region, however, have been greatly handicapped by the unfavorable drying conditions, sudden showers, heavy dews and the humidity in the atmosphere being detrimental to curing alfalfa in a natural way, resulting in great loss and expense as well as producing an inferior quality.

All of these detrimental features have been overcome by the advent of a dehydrating plant operated by natural gas, developed by the Arnold Drier Co. and manufactured by the Heil Co. of Milwaukee, Wisconsin. Development of this drier came as a result of considerable experimentation over the past several years, notably at Hayti, Missouri.

A number of these machines are being operated in various parts of the United States. The first dehydrator to use natural gas was installed on the plantation of Hon. Alfred Stone near Greenville, Mississippi. Natural gas proved itself superior to any other fuel for this purpose, responding instantly to variations in volume of heat required and maintaining a uniform product of combustion within a wide range of variations.



Close-up of furnace and burner installation at dehydrating plant.

Immediately after the alfalfa is cut in the meadows it is loaded and delivered to the dehydrating plant. It is then run through a chopper which reduces the alfalfa into lengths of about one inch. From here the alfalfa passes into the dehydrator.

Operation of the dehydrator is practically automatic. A thermostat maintains the proper heat under all varying conditions of temperature and volume of material fed into the machine, thus assuring a uniform quality and a predetermined moisture content in the finished product. The products of combustion are drawn by a fan from the furnace, mixed with sufficient air which is admitted back of the baffle wall in the furnace; this combination enters a triple revolving drum into which the green alfalfa is fed, entering the drum at a temperature of approximately 1100° F. The products of combustion, heated air and the alfalfa are drawn through three compartments in the drum on the suction side of the fan, then discharged through a separator which eliminates the moisture and deposits the dehydrated alfalfa. The temperature of the air and the material when it leaves the drum is approximately 250° F.

Coming from the separator the dehydrated alfalfa is fed into a hammer mill which renders it into meal. All of the natural oils and vitamins are retained in the alfalfa meal by this process. The meal, which has the natural color of light cream, is a basis for all mixed feeds for live stock and chickens.

The first dehydrating plant is modern in every detail, constructed of concrete and steel. Capacity of the natural gas-fired furnace is 6,000 pounds of moisture evaporated per hour, which is approximately equivalent to producing two tons of dry hay per hour. Gas consumption is approximately 12,000 cubic feet per hour, dehydration by this method comparing favorably with costs of curing alfalfa under natural conditions.

Operation of the plant is seasonal, beginning in March and terminating about the first of September. It runs 24 hours a day, six days out of the week on regular operation. Running continuously

(Continued on Page 61)

The Longitudinal Movement *of* Underground Pipelines

By G. S. BEITLER

Engineer, Transmission Division,
Main Line Department,
The Ohio Fuel Gas Company

G. S. Beitler

AS THE natural gas industry continues to expand and transmission lines are being laid across country for relatively long distances, more attention is being paid to the problem of expansion and contraction of these lines which are being rapidly placed into useful service. Although written data at the present time are rather meager, some useful conclusions may be drawn from past experiences and computations may be made which will show us that both the contraction and expansion of pipe lines underground are factors of importance which must be considered and properly taken care of.

In cases where proper thought has not been given to this problem, the experiences have been somewhat disastrous.

A list of the more important items to be considered is as follows:

1. Type of line—coupled, welded, screwed or welded and coupled.
2. Temperature at time of laying.
3. Temperature change to be expected in service.
4. Length of line.
5. Nature of soil—sand, silt or clay.
6. Diameter of pipe.

As the type of line decides whether we have a problem present or not, it is proper that we observe first how the selection of the joints for proposed pipe lines will influence our problem.

1. Type of Line—Rubber Coupled Welded, Screwed or Welded and Coupled.

A completely rubber coupled line may be regarded as having sufficient expansion provision made at every joint and need not be further considered, while some thought must be given to an all-screwed or an all-welded line and to a combination welded and coupled line.

While it is conceivable that a certain amount of compressive stress might be set up in a coupled line, yet due to the type of construction, it is impossible for any tensile stress to take place. On the other hand with all-welded or screwed lines an entirely different problem is presented, as both compressive and tensile stresses can take place, the latter tending to rupture the line at some point. This has formerly been taken care of by providing slack loops in the line, but when we come to the larger sizes of lines such as are met with more and more in recent years the question of providing sufficient slack is somewhat different, as widening the ditch to care for slack arches increases the cost appreciably. Again if the slack is placed vertically, the movement of the pipe up and down (if of any great extent) may cause it to work out of the ditch.

It is interesting to note that there are on record several large size pipe lines of all-welded construction which have given no trouble.

A line of welded and coupled construction is considerably different than either of the others, for while it can be thought of as a coupled line composed of extra long joints with provision for movement at each coupling, yet due entirely to the fact that the joints are very long, the couplings will be compelled to take up that much more movement. While they may do so without pulling apart, yet the wear on the rubbers will be more severe and the maintenance of the couplings will increase. The same will hold true of long sleeves or special expansion glands.

2. Temperature at Time of Laying Line.

The temperature at the time of laying will usually be different than the temperature the pipe assumes after being backfilled and so must be considered.

It is conceivable that the two may be of the same order of magnitude which in such rare cases would obviate any trouble from that standpoint.

The usual procedure on the construction of transmission lines in some localities is to backfill the pipe in the ditch at that time of day when atmospheric temperature more nearly approaches ground temperature. In the southwest and southern states this item assumes great importance.

3. Temperature Change to Be Expected in Service.

The temperature change to be expected in service will determine the expansion and contraction to be encountered.

TABLE NO. I—CHANGE IN LENGTHS IN INCHES PER 1,000 FEET OF PIPE—30° TO 70° F. TEMPERATURE VARIATION UNDERGROUND

Lay.	Expansion at		Contraction at		Movement due to diff. between laying temp. and max. ground temp.		Movement due to variation in ground	Total move-
Temp.	70°	30°	70°	30°	Contraction	Expansion	temperature	ment
140°F.			5.5″	8.7″	5.5″		3.2″	8.7″
130			4.8	7.9	4.8		3.2	7.9
120			4.0	7.1	4.0		3.2	7.1
110			3.2	6.3	3.2		3.2	6.3
100			2.4	5.5	2.4		3.2	5.4
90			1.6	4.8	1.6		3.2	4.8
80			.8	4.0	.8		3.2	4.0
70				3.2			3.2	3.2
60	.8″			2.4		.8″	3.2	3.2
50	1.6			1.6		1.6	3.2	3.2
40	2.4			.8		2.4	3.2	3.2
30	3.2					3.2	3.2	3.2
20	4.0	.8				4.0	3.2	4.0
10	4.8	1.6				4.8	3.2	4.8

In our territory the ground temperature change rarely exceeds 40° F. This figure is taken from actual observed field data and represents extreme conditions. By using 40° F. as an extreme temperature variation, calculations may be based on it with a margin of safety included in the results.

Table No. 1 gives the approximate change in length for various assumed temperature conditions.

4. Length of Line.

The length of line has a direct bearing on the total amount of expansion and contraction to be encountered. This is considered in conjunction with the varying temperature along the line and holding power of the backfill. The length will also have considerable to do with the flexibility.

5. Nature of Soil—Sand, Silt or Clay.

The texture of the soil is an important part of our problem as certain soils, notably clays, will offer considerable resistance to pipe expansion due to the adherence of the soil to the pipe, while in sands this effect will be very limited. In addition to the question of the soil resisting pipe movement by its adherence, different soils will vary in the conductance of heat so that a clay soil at pipe depth will remain at a somewhat different temperature than at the surface, while the sands will, to the contrary, conduct heat more rapidly both to and from the pipe. As a rule, silty soils occur chiefly above pipe depths and are restricted in scope. Loams occur as a mixture of sand, silt, and clay and are generally surface soils of shallow depth. An interesting fact was observed during the drought of last summer in certain clay soils which were quite moist and cool at pipe depth in spite of the lack of rainfall over a protracted period.

6. Diameter of Pipe.

The diameter of the pipe is to be considered from two standpoints; first, the area offered to the gripping power of the soil and second, the stiffness of the pipe or resistance to bending for slack. As the diameter increases in size, the difficulty in obtaining ditch slack becomes more pronounced.

Computations to determine the coupling locations exactly for small diameter lines such as 3-inch and under are not necessary, as ditch slack can be obtained with comparative ease.

Assuming 1,000 ft. of line in the ground, we can reasonably expect a variation in temperature of approximately 40° F. at pipe depth throughout Ohio. The total expansion and contraction of this line for 40° F. would be approximately 3.2 inches. To provide for this movement, if we assume that line sizes up to 12-inch use coupling rubbers of one width while all sizes 12-inch and above use a wider rubber, we may allow ¼-inch roll per coupling on the former and ½ inch roll per coupling on the latter sizes. This will necessitate 13 couplings per thousand feet for sizes under 12-inch in diameter (narrow rubbers) and seven couplings per thousand feet for 12-inch and over (wide rubbers) or approximately 80 feet, and 140-160 feet between couplings, respectively.

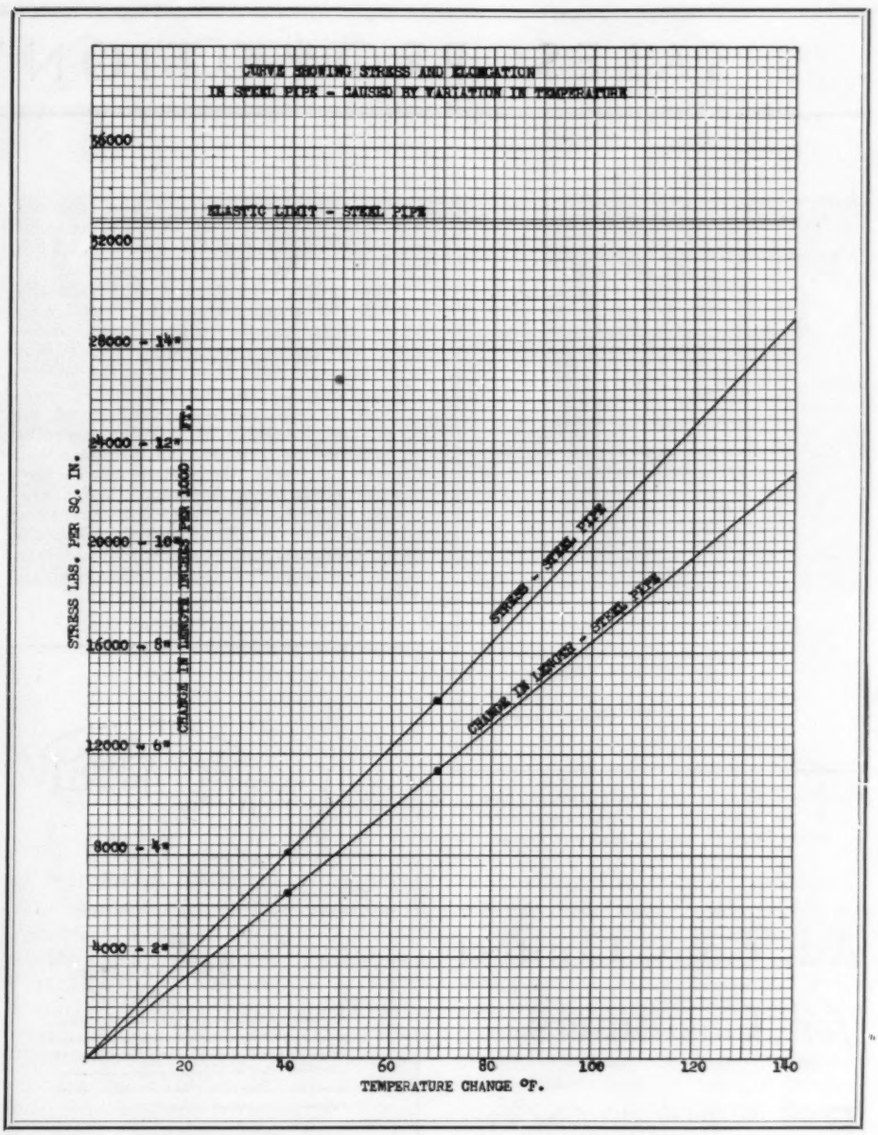


Fig. 1.

While these figures will take care of pipe movement after the line has assumed the temperature of the earth, yet another factor must be considered —the temperature of the line at time of laying, which will affect the initial temperature drop and therefore the contraction of the line. If the pipe has been lying in the sun at an atmospheric temperature of 100° F., the pipe may be considerably warmer due to the fact that it will absorb heat faster than it can radiate, so it is possible for it to reach a temperature of 140° F. If the pipe is laid at this temperature, some provision must be made for the contraction that will take place as soon as the pipe cools to normal ground temperature, say possibly 70°, giving an initial temperature drop of 70° and a decrease in length of 5.5 inches. It will be necessary to take care of this initial decrease in length by some method other than the use of couplings, as after the line has reached normal ground temperature, it will not, except in extremely adverse conditions, go back to this former high value. Therefore, it seems best to provide for this by the means of

(Continued on Page 36)

. . SALES PROMOTION DIGEST . .

SUBMITTED IN "COPY" CONTEST

March 9, '32

Helps for Successful Editor
P. G. and E. Progress
245 Market Street, San Francisco

THINK
ECONOMY
IS IN
WISE SPENDING

One manufacturing plant on the Peninsula, by changing over to natural gas for heating, has during 1931 made a saving of 31.9% over the former cost of using oil. We will supply the name of this firm to anyone interested.

Your fuel bills may be lowered proportionately by using this clean, convenient, and efficient fuel--natural gas.

Telephone any P. G. and E. office for data, or ask any one of our thousands of employees to have the desired information sent to you.

P. G. and E.

(The firm mentioned above is the Pacific Press Publishing Association of Mountain View. The figure was taken from the superintendent's annual report.)

Submitted by Arthur F. Browne
Address given at top of sheet.

Above and at the right appear two of the winning advertisements submitted in P. G. and E. customer contest.

Ad. Copy Contest *for* Customers

FOR the utility advertising department there is an idea worthy of being put to use contained in a contest recently concluded by the Pacific Gas and Electric Co. During the Spring months the company's publication "P. G. and E. Progress", which each month reaches every consumer, sponsored an ad-writing competition among the company's customers. Three main motives lay behind the contest idea, according to R. O. McGougan, editor of "P. G. and E. Progress":

1. To attract additional attention to Pacific Gas and Electric Co. advertising.

2. To encourage company patrons to study its policies and activities.

3. To develop ideas from customers which could be adapted to use in future advertising.

Contest announcements were phrased in line with these requirements. They invited customers to:

"Write an advertisement for the P. G. and E. What about? About any feature of its operations or policies. Study Pacific Service advertisements for a time and decide what you would say in the same space if you were running the company. Then put it in writing.

"Your advertisement may deal generally with the advantages of using gas and electricity or specifically with the merchandising of any gas or electric appliance. It may cover service for the home or for the factory.

"You may, if you choose, write an institutional advertisement—one telling of the P. G. and E. policy of steadily extending its facilities to help develop Northern and Central California, the widespread employment of labor on its huge construction programs, its consistent practice of purchasing many millions of dollars worth of locally made materials and equipment every year, or its continued efforts to aid established industries and to attract new payrolls."

... for speedy, satisfying heat
Reach for a button instead
Back of the button a good furnace, back of the furnace NATURAL GAS,
PACIFIC GAS AND ELECTRIC COMPANY
P·G·and·E·

Cash prizes were offered for best copy material—first prize $15, second $5, and 15 awards of $2 each. Advertisements were received from every section of the company's service area in Northern and Central California, most of them indicating that company advertising and publicity had been studied by the writers.

Of the many entries, the accompanying illustrations reproduce two which were representative of the type of copy among the prize-winning entries. The "ad" on the left stressed the economy of natural gas for industrial heating, while that on the right emphasized the comfort and convenience of automatic gas heating for the home. Many of the advertisements were "institutional" in tone, showing customers' familiarity with the company's service and policies.

Unsold Water Heater Markets

AN article entitled "Merchandising Trends of 1931-32," appearing in *Western Gas* for May of this year, called attention to a number of specific instances of unsaturated markets for domestic gas appliances. More evidence of the same sort, showing the amazing sales opportunity which the industry must capitalize, is contained in a statement received last month from the Mid-West Gas Association, relating to the water heater market. Quoting from this statement:

"In a recent check-up in one of our Mid-Western cities, it was found by the gas company that less than 10 per cent of the customers are using storage water heaters, in spite of the fact that this particular city, has for a good many years, made an intensive job of selling storage heaters. In the same check-up it was found that less than 1 per cent of the customers have instantaneous heaters. The total water heaters of the three types combined would not equal 40 per cent of the customers. The other 60 per cent, or better, have nothing with which to heat water in the summer time except the old fashioned tea kettle or water bucket.

"Most of the customers who have no water heaters, are among the large majority who pay the gas company less per month than it costs the gas company to serve them. With these things in view, we cannot put too much effort behind the job of selling water heaters, for it is plain that selling water heaters is not a replacement proposition.

"From records that have been given out in the past few years, it is plain that the maximum volume of water heater sales will not be reached unless the price to the customer is reduced. It is, also, plain that the maximum will not be reached unless the operating expense is low. The small low-priced heater offers us the best chance for volume sales . . . Whether it be the gas company or the plumber who will eventually sell the heater, the question of quality should be settled at the outset and great care should be exercised against installing heaters wherein the tanks are too thin or where a few years of service will render them useless.

". . . the gas industry is more enlightened and better equipped to sell water heaters today than it was to sell gas ranges twenty-five years ago, and to show how gas ranges have progressed in twenty-five years it may be added that in the same checkup where less than 40 per cent of the customers were found to be heating water with gas, over 99 per cent were cooking with gas.

"If we all put our shoulders to the wheel we will have 99 per cent of our customers heating water with gas in much less time than twenty-five years."

. . SALES PROMOTION DIGEST . .

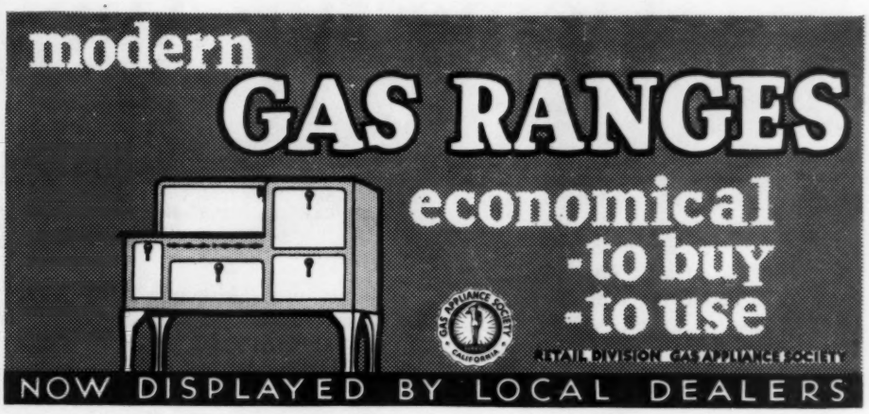
Circus Ballyhoo Is Campaign Key

SALES executives of the Minnesota Northern Power Co. are firm believers in the art of ballyhoo as a merchandising asset—and they make it produce, as witnessed by results already obtained in the "Big Show" campaign, a three months specialized sales program inaugurated at the Spring Rally and Sales Meeting of the company, held at Glendive, Mont., April 29 and 30.

A program of 18 "Big Acts", with the circus motif predominating introduced the campaign to salesmen throughout the system gathered at Glendive. The 18 acts were featured on the program as displays, given in two theaters of the town. These "displays" included talking pictures, talks by sales executives of the company illustrated with slides or film, and two skits. One of the skits, titled "On the Spot," was written by A. E. Schwarz, commercial manager for the company, and in a clever way personalized the various gas appliances. A "side show" was the final feature of the program, for which manufacturers' booths were set up with representatives in gaudy attire presiding. Eats, enter-

(Continued on Page 37)

This prospectus ushered in the "Big Show" sales drive.



This billboard "copy" will be used during the Gas Appliance Society's Promotional Gas Advertising Campaign.

More Western Cooperative Advertising

COOPERATIVE advertising of gas appliances in the West receives an important boost in the Gas Appliance Society's newly announced "Promotional Gas Advertising Campaign," for which a fund of $20,000 is being raised to be expended over a period of 12 months. Distributor, dealer, and utility participation is provided for in the plan, and compaign moneys are being raised as sales are made. In its present scope the campaign will be effective in some 130 communities of Northern and Central California.

The fund will be raised by the sale of Promotional Gas Advertising Stickers by the Gas Appliance Society of California to distributors for their use on all gas ranges, cookers and circulating heaters shipped to towns where the campaign is in effect. The stickers will be priced at 50c each for ranges, and 30c each for cookers and circulating heaters, and will be sold in books of 50 each. The distributor bills the retailer to whom he sends an appliance for one-half the cost of the sticker on that appliance.

For every $2 raised jointly in this manner from the distributors and the retailers, the Pacific Gas and Electric Co. has agreed to contribute one dollar.

The advertising program which has been worked out by a committee of advertising experts from various firms, who are members of the Gas Appliance Society, will include the use of bill boards, newspaper advertising, countercards, etc.

The advertising at this time will be distributed throughout the territory served by the Pacific Gas and Electric Co. If, at a later date, other utilities come into the plan on the same basis as the P. G. and E. (i.e., contributing one-third of the campaign fund to be spent in their territory, the advertising campaign will be enlarged to include those towns served by the other utilities.

The advertising appropriation will be spent in each community in proportion to the amount of money contributed by the retailers in that particular community. Thus to the retail dealer, the Promotional Gas Advertising Campaign offers unusual advantages.

Stickers are to be placed on the backs of the appliances by the distributor. On ranges, the stickers are to be glued to the backs of the ovens. The distributor's shipping clerk who tears a sticker out of the book, is to write the name of the town to which the appliance bearing that sticker is being sent, on the stub from which the sticker is detached. When the 50 stickers contained in a book have been used, the plan calls for the returning of books with the stubs intact to the Gas Appliance Society headquarters in San Francisco. Each sticker bears a serial number and the copyrighted seal of the Society in order to safeguard the plan from any possible misuse.

A Maintenance Service *for* Domestic Appliances

By C. R. MILLER

Superintendent Utilization
*Portland Gas & Coke Company**

MANY domestic gas consumers, through carelessness or lack of proper knowledge, permit gas appliances to get into a condition where the utility is greatly impaired. This may come about through the gradual accumulation of grease, dirt, corrosion, breakage, or lack of proper adjustment. A range or other appliance in this condition does not only give unsatisfactory results but its general appearance is greatly impaired, and it is a poor advertisement for a utility, even though the company is in no way directly to blame for the condition.

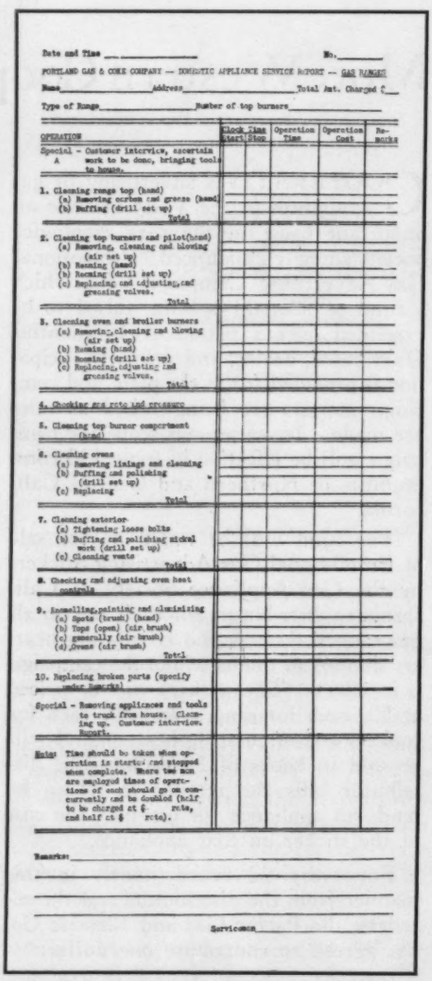
C. R. Miller

Too many customers fall back on the time-worn excuse that gas is greasy and dirty, and it is impossible with the facilities at hand for them to keep the appliances in a presentable condition. We of the industry realize that there is no good excuse why gas appliances cannot be properly maintained by users if they have the willingness to do it. Substantiating this statement, all that we are called upon to do is to refer to the thousands of customers constantly keeping their appliances in a presentable manner, and the greater majority passably so, aided now and then by an occasional call from our service departments.

It is not uncommon to receive the most critical complaints and experience the most dissatisfaction with the more careless or indifferent customers, as it pertains to the operation of their appliances and/or high bill complaints, and it was with the thought in mind of determining the best method of handling this particular class of customers that we started a study of the problem something like a year ago.

We first investigated the practicability of establishing a service whereby a customer's appliances would be removed from the premises, brought into the shop, thoroughly overhauled, repaired and reconditioned, in the meantime connecting a service appliance on the premises for temporary use. Although we took advantage of all available shortcuts, as applied to mechanics, interruptions to service, and accounting, the expense proved too high to encourage popular acceptance.

We then followed out our other idea in the matter, which amounted to equipping a small, high-speed delivery truck with the tools and equipment thought necessary to accomplish an entire cleaning job on the premises of the customer, wherein ranges, water heaters, space heaters, and other small domestic appliances might be entirely overhauled and cleaned at a cost sufficiently low to encourage acceptance by those most in need of such service.



Date and Time _____ No._____

PORTLAND GAS & COKE COMPANY — DOMESTIC APPLIANCE SERVICE REPORT — GAS RANGES

Name_____Address_____Total Amt. Charged $___

Type of Range_____Number of top burners_____

OPERATION	Clock Time Start	Stop	Operation Time	Operation Cost	Remarks
Special - Customer interview, ascertain A work to be done, bringing tools to house.					
1. Cleaning range top (hand) (a) Removing carbon and grease (hand) (b) Buffing (drill set up) Total					
2. Cleaning top burners and pilot(hand) (a) Removing, cleaning and blowing (air set up) (b) Reaming (hand) (b) Reaming (drill set up) (c) Replacing and adjusting,and greasing valves. Total					
3. Cleaning oven and broiler burners (a) Removing, cleaning and blowing (air set up) (b) Reaming (hand) (b) Reaming (drill set up) (c) Replacing, adjusting and greasing valves. Total					
4. Checking gas rate and pressure					
5. Cleaning top burner compartment (hand)					
6. Cleaning ovens (a) Removing linings and cleaning (b) Buffing and polishing (drill set up) (c) Replacing Total					
7. Cleaning exterior (a) Tightening loose bolts (b) Buffing and polishing nickel work (drill set up) (c) Cleaning vents Total					
8. Checking and adjusting oven heat controls					
9. Enamelling,painting and aluminizing (a) Spots (brush) (hand) (b) Tops (open) (air brush) (c) generally (air brush) (d) Ovens (air brush) Total					
10. Replacing broken parts (specify under Remarks)					
Special - Removing appliances and tools to truck from house. Cleaning up. Customer interview. Reports.					
Note: Time should be taken when operation is started and stopped when complete. Where two men are employed times of operations of each should go on concurrently and be doubled (half to be charged at $ rate, and half at $ rate).					

Remarks:_____

Servicemen_____

The form shown above, while applying to ranges, is typical of the forms used in the company's domestic service report for each type of appliance.

In order that our problems may be better understood, it might be well briefly to describe our company and its service policies. We have 75,000 domestic customers. The metropolitan part of our system encompasses, roughly, 430 square miles of territory in which we have 2,191 miles of high and low pressure main. Our mains extend beyond the city limits to surrounding towns in all directions for an average distance of 36 miles. The farthest point is nearly 100 miles away from the plant. With the exception of four resident service men residing in small towns in the outlying districts, our entire operations are carried on from the central office in the metropolitan area.

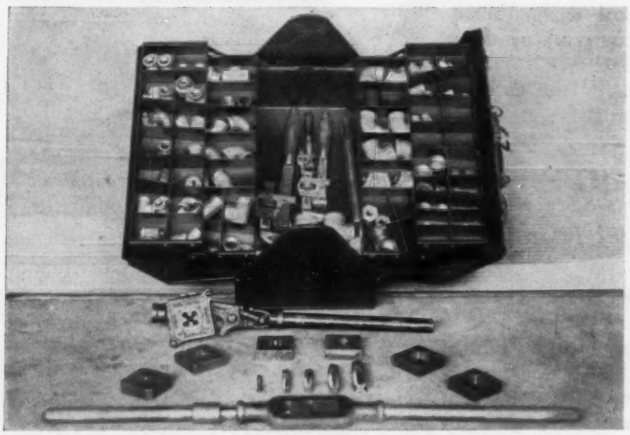
All gas-burning appliances, regardless of their make or where they were purchased, are serviced without charge. The service includes regulation of valves and controls, minor burner cleanings, advice and counsel regarding the use and maintenance of the equipment. This work is done by 25 service men who cover definitely assigned routes in light delivery trucks. In addition to answering ordinary service calls, these men also lock and turn on meters, set and remove meters and governors, deliver and sometimes install small appliances, depending upon the time they have available. These activities increase or decrease in volume as the weather, seasons of the year, or time of the month influence their normal service work.

Where the work on the customers' premises with regard to servicing appliances amounts to more than we choose to consider ordinary service work, the service man obtains a charge order for the additional work. This may amount to replacing a burner, a valve, or a

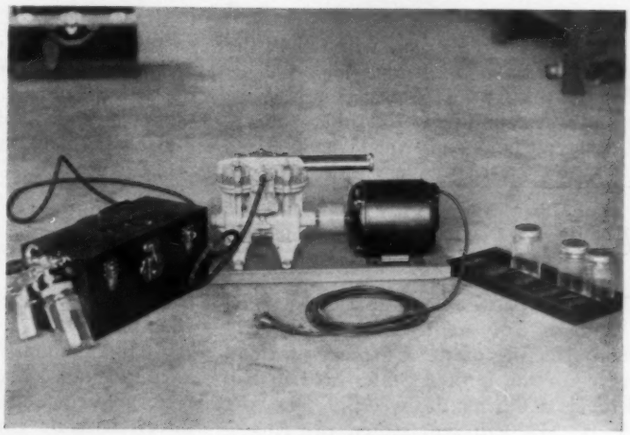
*Presented before the American Gas Association Ninth Annual Distribution Conference, Birmingham, Ala., April 6-7-8, 1932.

All small tools and equipment are contained in these boxes.

Domestic appliance maintenance truck and man in uniform.



Box of pipe fittings and tools.



Paint spray gun and equipment.

hinge; repairs to oven controls, broken doors; or repairs to water heater coils or parts.

We have in the neighborhood of 10,000 house heating customers, including both minor and major types of installations. Our attitude toward house heating appliances is similar to that of domestic appliances as it may pertain to the make of the appliance, by whom installed or used. We gladly answer all service calls pertaining thereto, without charge, any time during the day or night.

In addition, however, we have a house heating inspection service for which there is a charge of $2.50 more or less, depending upon the size of the appliance to be considered. This inspection includes an examination of the vent pipe, chimney, radiation, valves, controls and thermostat; a smoke test for leakage; and a discussion with the customer regarding the appliance. If the appliance is found to be in good working order, the customer is so advised, and a charge for the inspection included in the current gas bill.

On the other hand, if the furnace is in need of repairs or alterations; or if a major cleaning is thought advisable; or in case the chimney requires cleaning or repairing, the customer is advised of these recommendations and is given the preference of signing an order at the time for us to do the work, or he is referred to several local heating contractors or furnace men who are equipped to perform the services required on the particular appliance involved.

We have a sales department wherein all manner of gas appliances are sold, including domestic, hotel and industrial units. We maintain an installation crew and install our own appliances as well as a goodly number of appliances sold by other local dealers. We maintain a sheet metal and appliance repair shop. An earnest endeavor is made by our company to cooperate with other appliance dealers in the community, and we are particular in maintaining the class of appliances sold, the price, and the service to an acceptable high standard. While there is as yet no city ordinance governing the class of appliances distributed, we sell nothing but A.G.A. Approved Appliances, and for the past two or three years have been encouraging local dealers to do likewise.

With that resume of our service and sales policies at hand, it is thought that a better understanding may be had of our new venture in connection with customer service.

Our first problem was to determine the extent to which we could and should go in reconditioning appliances on the premises of our customers with ordinary tools and equipment. Also, it was necessary to determine the time required to do the work. To this end, all available data pertaining to the service records were examined, and questionnaires were submitted to all individuals in our company who were thought to be in a position to render opinions concerning the major items that would be necessary to consider in rounding out the entire subject. With these conclusions at hand, a light delivery truck was outfitted with

(Continued on Page 50)

Pacific Coast Gas Association

Managing Director: Clifford Johnstone

Association Headquarters: 447 Sutter St., San Francisco

President: Jas. L. Stone

Vice-President and Gen. Manager, Spokane Gas and Fuel Co.

Program Shaping for 39th Convention

SECTION chairmen are now actively engaged in perfecting plans for a notable Convention program at Del Monte, August 24-26, inclusive. The entire gas industry has been active for the past year with some of the most intensive advertising and sales plans in its history. In spite of the general depressed state of business, encouraging results have been obtained.

The 39th Convention will reflect the optimistic spirit which pervades the industry, this optimism being occasioned by the certain knowledge that the industry can hold and expand its markets if and when general business reaches anything like a normal condition.

President Stone has appointed T. W. Snell as General Convention Chairman. Mr. Snell is Division Manager of the Coast Valleys Division of the Pacific Gas and Electric Co., with headquarters at Salinas. His familiarity with conventions in general and Del Monte conventions in particular will enable him to use to the fullest extent all of the magnificent facilities of Del Monte and the Monterey Peninsula for the entertainment and comfort of those attending the Convention.

U. S. Chamber of Commerce Meeting in San Francisco

THE Pacific Coast Gas Association was fully represented at the Annual Meeting of the Chamber of Commerce of the United States held in San Francisco during the week of May 16. A. B. Macbeth represented the American Gas Association as National Councillor and C. O. G. Miller represented the Pacific Coast Gas Association in the same capacity. Official delegates and alternates of the Pacific Coast Gas Association were as follows:

Henry Bostwick	A. F. Hockenbeamer
C. Y. Bowers	Geo. L. Myers
John P. Coghlan	W. F. Raber
Addison B. Day	Don C. Ray
R. E. Fisher	F. J. Schafer
	F. S. Wade

Harry C. Abell, Past President of the American Gas Association, was re-elected as a director of the National Chamber.

At this Annual Meeting business took a courageous stand in behalf of more freedom in action for business and less interference by government in business. Leaders from all parts of the United States stressed the necessity of more economy in government with its accompanying release from heavy taxation, and also for the repeal or amendment of the anti-trust laws which throttle all attempts of business to put its house in order.

Remember the Dates for 1932 Convention

Time: August 24-26, inclusive.

Place: Del Monte, Calif.

Occasion: Thirty-ninth Annual Convention, Pacific Coast Gas Association.

Public Speaking Contests Getting Under Way

THERE will be two Public Speaking Contests in the Association this year, as usual—one for women and one for men. The same subject has been chosen for both the Men's Contest and the Women's Contest—"My Company As a Community Asset."

The Women's Contest is being directed by the chairman of the Women's Committee, Miss Clarita Scott, Los Angeles Gas and Electric Corp. The Men's Contest is under the direction of the chairman of the Committee on Employees' Education, Daniel L. Scott, Los Angeles Gas and Electric Corp.

An announcement of contest details has been circulated to member companies and Company Contest Directors are being appointed immediately for the Men's Speaking Contest. Contest directors are also being named for the Women's Contest, in companies where there is no local Women's Committee Chairman.

Any gas company employee except executives, general department heads, or district or division managers, is eligible to enter the contest; except that those who represented their companies in the contest of 1931 may not compete in the current contest.

Nominating Committee Appointed

PRESIDENT Stone has appointed the following members of the Association, each of whom is a Past-President, as members of the Nominating Committee:

F. H. Bivens, Los Angeles, Chairman.
C. B. Babcock, San Francisco.
H. R. Basford, San Francisco.
E. L. Hall, Portland.
W. S. Yard, San Francisco.

The Committee's nominations will be published in the July issue of *Western Gas*.

Research Fellowship in Gas Engineering

The committee of selection for the Association's Research Fellowship in Gas Engineering at the University of California has chosen Gordon Robert MacPherson as the holder of this Fellowship for the year 1932-33. Mr. MacPherson is a graduate of the University of California in mechanical engineering and was selected over all other candidates for the Fellowship by reason of his outstanding record as a student and his special interest in the problems of the gas industry.

O. F. Anderson Named Foreman of Watsonville Gas Department

O. F. Anderson, formerly with the Los Angeles Gas and Electric Co., Los Angeles, Calif., has been employed by the Coast Counties Gas and Electric Co., Santa Cruz, as foreman of the gas department in the Watsonville, Hollister and Gilroy areas.

Mr. Anderson was formerly in charge of the change-over work when natural gas was turned into the area served by the Coast Counties Gas and Electric Co.

Death of Wm. E. Robbins, Treas. of Southern California Gas Company

W. E. Robbins

WILLIAM E. ROBBINS treasurer of the Southern California Gas Co., died on April 26 at Garfield Hospital, Monterey Park, Calif., following a month's illness.

Mr. Robbins had been associated with the company for nearly 20 years, since April 16, 1913. He filled positions of clerk, bookkeeper, chief clerk in the auditing department, auditor, general auditor and finally treasurer. He was an active member of the Pacific Coast Gas Association, serving as chairman of the accounting section during the 1927-28 period.

B. C. Electric Has Novel Water Heater Window Display

A novel idea was used to advantage by the gas department of the B. C. Electric Railway Co., Ltd., Vancouver, B. C., in a recent window display of gas water heaters. A cut-out of Sir Harry Lauder was used as the main figure of the display, shown against a black drape. Wire was strung across the lower center of the window to represent lines in a bar of music. On these lines the sharp and flat notes of "It's nice to get up in the morning" were arranged. For the benefit of those unable to read music the actual words were also cut out in wooden letters and secured below the music. The second line was altered to tie in with the display of gas water heaters, and the actual wording of the song was:

"Oh, it's nice to get up in the morning
When you don't have to wait for hot water."

The same wording was used on the center card and continued thus:

". . . Play safe—get a gas automatic hot water heater."

A number of heaters completed the exhibit. The window was arranged by W. Parnum, display manager of the company.

McMinnville, Dundee and Lafayette Scheduled for Service

Portland Gas & Coke Co., Portland, Ore., is applying for a franchise to serve gas in McMinnville, Ore., and according to E. L. Hall, general superintendent for the company, should a satisfactory franchise be granted, a 4-inch line will be laid from Newberg to McMinnville, a distance of approximately 12 miles. The line would be laid along the State Highway and would pass through the towns of Dundee and Lafayette.

Uniform Classification of Accounts Available For Distribution

The Uniform Classification of Accounts for Natural Gas Companies, prepared by a committee of the National Association of Railroad and Utilities Commissioners, and recommended by it for adoption by state commissions, has been published by that association in pamphlet form. Copies are available at $1 post paid from the American Gas Association, 420 Lexington Avenue, New York, or from James B. Walker, secretary, National Association of Railroad Utilities Commissioners, 270 Madison Avenue, New York.

First Quarter Figures on Operations

A STATISTICAL statement prepared by the Pacific Coast Gas Association comparing gas company operations for the first three months of 1932 with the same period in 1931 was released in May. As shown in the totals below, production has decreased 7.8 per cent on the Coast as a whole. This decrease is accounted for largely by a drop in the natural gas purchased by California companies, although Oregon also showed a slight decrease.

The number of active meters increased 1 per cent in California, all other states decreasing slightly.

Cubic foot sales show to a marked degree the effect of the industrial curtailment and the difference in temperature conditions in the first quarter of 1931 and the first quarter of 1932. Domestic sales increased 26 per cent due to the contrast between the record warm weather of 1931 and the record cold weather of 1932. Industrial sales decreased 24.1 per cent, leaving total sales with an increase of less than 1 per cent.

Due to the fact that a larger proportion of 1932 sales were in the domestic classifications carrying a higher rate, the total gross revenue increased 13.5 per cent.

A detailed statement of operations, arranged by geographical sections, has been sent out to company members of the Association. Summarized figures for the whole area covered in the report are given below:

GAS COMPANY OPERATIONS FOR THE STATES OF CALIFORNIA, ARIZONA, NEVADA, OREGON AND WASHINGTON, AND THE PROVINCE OF BRITISH COLUMBIA

First Quarter 1932 Compared with Same Period in 1931

	First Quarter 1931	First Quarter 1932	Per Cent Change
Production—M.c.f.			
Water Gas	836,423	872,448	
Coal Gas	389,070	413,209	
Oil Gas	2,413,575	2,481,778	
Coke Oven Gas	159,289	178,315	
Butane Gas—550 B.t.u.	7,796	90,017	
Natural Gas Purchased	44,800,806	40,790,315	
Total	48,606,959	44,826,082	— 7.8%
Active Meters—March 31			
Domestic	1,553,275	1,557,417	
Industrial	67,650	69,893	
Total	1,620,925	1,627,310	+ 0.4%
Sales—M.c.f.			
Domestic	19,257,356	24,265,998	+26.0%
Industrial	20,609,005	15,635,954	—24.1%
Total	39,866,361	39,901,952	+ .09%
Gross Revenue			
Domestic	17,864,549	21,479,826	+20.2%
Industrial	4,700,964	4,138,947	—12 %
Total	22,565,513	25,618,773	—13.5%
Miles of Main, March 31	24,306	25,327	+1021
Employees, March 31	12,503	11,212	—10.3%

Coast Counties Gas and Electric Conducts Series of Cooking Schools

A series of gas cooking schools have just been completed in the territory served by the Coast Counties Gas and Electric Co., headquartered at Santa Cruz, Calif. H. R. Basford Co. assisted in conducting the school. Mrs. Anna S. Peterson, well known home demonstrator on the coast, was the instructor.

Although other home appliances were shown and used on the stage, gas cooking was the principal feature demonstrated. Simple menus were followed, showing how efficiently and economically these were done in the new type automatic, oven controlled gas ranges.

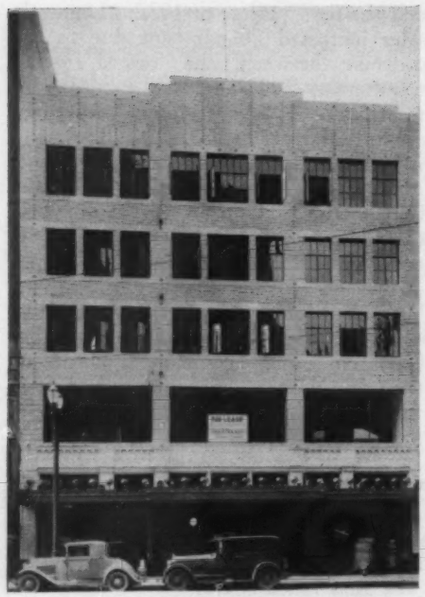
After each demonstration the food was passed out as samples to the housewives and they were invited to ask questions concerning the operation of the appliances or any housekeeping problems and to inspect the ranges and other equipment.

A total of approximately 2,500 housewives attended the schools which were held in Santa Cruz, Watsonville, Los Banos, Crockett, Pittsburg, Martinez, Antioch and Walnut Creek.

Pacific Advertising Clubs Assn. to Meet in Vancouver, B. C.

J. Lightbody, director of publicity for the British Columbia Electric Railway Co., Ltd., Vancouver, B. C., announces that the annual convention of the Pacific Advertising Clubs Association will be held in Vancouver, July 5 to 9. Mr. Lightbody is general convention chairman. Representatives from the entire Pacific coast area are expected to attend, many of whom will be public utility advertising men.

Seattle Gas Co. in New Headquarters



Gasco Building, Seattle, Wash., where Seattle Gas Co. recently set up its headquarters, ocupying four floors.

REMOVAL of the Seattle Gas Co. to the new Gasco Building, 1507 to 1511 Fourth Avenue, Seattle, marks the end of four months reconstruction activities, and an expenditure of approximately $750,000.

An old-fashioned housewarming, April 30, introduced the new home to Seattle residents. There were 15,800 guests of the gas company in attendance during the afternoon and evening. A program featuring three radio broadcasts, a negro quartet and trained dogs comprised the day's entertainment.

Seattle Gas Co.'s new home provides a modern 5-story office building with adequate light and visibility for all office and salesroom purposes. The front of the building has been renovated completely, a light faced brick brightening the appearance.

Of the company's 425 employees, 190 are housed directly in the new building or work out of it, including meter readers, salesmen, and collectors.

L. E. Lindsay, architect for Central Public Service Corp., Chicago, supervised the reconstruction, assisted by A. H. Albertson, Seattle architect.

First, third and fourth and basement floors of the 5-story building are used by the gas company. On the first floor is located a complete display of gas appliances, the enlarged quarters offering opportunity for adequate showrooms. In addition, customer services including payment of bills are to be found on the first floor. A model kitchen of Dutch design with all gas appliances is placed on the first floor for convenience of women visitors. Mrs. Beatrice Strege and Mrs. Ruth Hopkins, members of Home Service Department, preside over this kitchen.

Fred C. Foy, assistant general manager, and E. L. Keating, domestic sales manager, are to be found on the first floor, also members of the coke sales department.

The mezzanine off the first floor is equipped with couches and overstuffed chairs as a restroom for women employees of the organization.

The third floor houses the accounting department with P. R. Dunbar and A. B. Daab in charge. A feature of this floor is the accoustical ceiling which absorbs sound waves, maintaining a quiet atmosphere.

General offices and commercial sales department will be found on the fourth floor. Executives who have headquarters on this floor include James F. Pollard, general manager; J. Earl Jones, commercial sales manager; William I. Battin, general superintendent; Ray Trowbridge, industrial sales manager; Lynwood Fix, attorney, and A. Morley Horder, coke sales and service manager. In addition, addressograph and stationery rooms are to be found on the floor.

A home service demonstration hall which accommodates 200 persons and a salesmen's meeting room are located on the basement floor.

Total floor space occupied by the company is 25,964 square feet, or more than twice the size of its former quarters. The downtown offices are in addition to the plant on Lake Union and the shop. The gas company also maintains six district offices as well as stores in Renton and Kent.

Gas Service Co. Campaigns Succeeding; 900 Water Heaters Sold

An intensive automatic water heater sales campaign, begun on February 29, by Gas Service Co. new business departments under F. M. Rosenkrans, new business manager, ended the last of April with approximately 900 water heaters added to the company's load. It is reported that much of the success of the campaign was due to the cooperation of the other departments of the organization. Office and operating departments employees in all the Gas Service Co. subsidiaries cooperated by turning in hot tips to the salesmen, and in many cases made outright sales.

A new campaign was inaugurated May 2, and is scheduled to close June 25 with 1,000 gas ranges added to the company's domestic load. Six models of Detroit Jewel ranges have been selected for the sale, with the table top model especially featured.

Several sales meetings held throughout the company's system by Mr. Rosenkrans and his assistant Claude Gates, preceded the campaign. M. B. Buckley, new business manager of the Kansas City Gas Co., and Jack Torbert, new business manager of the Wyandotte County Gas Co., also assisted in the preliminary sales meetings. During the first 10 days of the 60-day sale, 157 ranges had been sold.

A. G. A. Report Shows Improvement in Gas Utility Sales

Revenues of manufactured and natural gas utilities aggregated $62,009,931 in March 1932, as compared with $64,318,405 in March 1931, a decline of 3.6 per cent, according to reports from 406 companies serving 14,039,322 customers and representing over 90 per cent of the public utility distribution of manufactured and natural gas, it was announced late in May by Paul Ryan, chief statistician of the American Gas Association.

This represents the smallest decline in revenues reported since May 1931, and indicates a distinct improvement during the first three months of the current year. In January 1932 revenues were 11.4 per cent below the preceding year, while in February the drop was only 5.7 per cent.

The manufactured gas companies reported revenues of $33,186,305 for March, a drop of 2 per cent from a year ago, while revenues of the natural gas concerns totaled $28,823,626, or approximately 5 per cent less than for March 1931.

Sales of manufactured gas reported for March totaled 31,919,608,000 cubic feet, a decline of less than 1 per cent, while natural gas sales for the month were 64,577,188,000 cubic feet, a drop of 8 per cent.

A substantial part of the improvement in manufactured gas sales was due to the greatly augmented use of this product for house-heating purposes. During March 1932 sales of manufactured gas for this purpose aggregated 3,134,825,000 cubic feet which represents an increase of nearly 19 per cent over the corresponding month of the preceding year. This was in sharp contrast to the drop of nearly 4 per cent which characterized this class of business in February.

Throughout the country generally, industrial gas sales, both for manufactured and natural gas utilities, continued at levels considerably below the preceding year, the decline in sales of manufactured gas for industrial purposes approximating 9 per cent for the country at large, while industrial sales of natural gas were down nearly 9 per cent from March 1931.

1932 Calendar

June

Canadian Gas Association—25th Annual Convention, Fort Garry Hotel, Winnipeg, Manitoba, Can., June 9 and 10, 1932.

Home Service Conference and Course in Domestic Gas Appliances—A. G. A. Testing Laboratory, Cleveland, Ohio, June 15-17, 1932.

Southern California Meter Association—Los Angeles, Calif., June 23, 1932.

July

Michigan Gas Association—Annual Convention, Grand Hotel, Mackinac Island, Mich., July 5-7, 1932.

Summer Course in Household Gas Appliances—American Gas Association in Cooperation with Columbia University, at Columbia, July 5-22, 1932.

August

Pacific Coast Gas Association—Thirty-ninth Annual Convention, Del Monte, Calif., August 23-26, 1932.

October

American Gas Association—Annual Convention, Atlantic City, N. J., October 10-14, 1932.

National Bottled Gas Association—The next meeting to be held at Atlantic City, N. J., in October, during A. G. A. sessions.

Trevitt Elected New Business Manager for Community Natural

PERSONNEL changes affecting several departments and properties in both Texas and Oklahoma have been announced by the Community Natural Gas Co., Dallas, distributing subsidiary of Lone Star.

S. E. Kerr, formerly new business manager, has been transferred to the tax department of the Lone Star Gas Co. C. L. Trevitt, formerly assistant new business manager, succeeds Mr. Kerr as manager, with Guy Custer as his assistant. Roy Webb, chief clerk of the new business department, has been transferred to the auditing department.

Joe Darrow, formerly in the home service department, has been transferred to Hugo, Okla., as division manager, replacing H. H. McMichael. Fay Bridges, formerly at Abilene, has succeeded Earl Pinkerton as division manager at Walters, Okla.

John M. Hendricks of Sweetwater, formerly special West Texas representative for the Community Natural, has resigned to manage the Sweetwater Board of City Development.

Jack Fatheree and Albert W. Sledge have been transferred from the home service department to the auditing department. J. O. Anselin has replaced J. H. Bates, Jr., as chief clerk at Abilene, and Anita Rhinelander has been transferred from the research department at Dallas to Abilene as assistant cashier. Mable Berry has replaced Mrs. Minerva Gerald in the operating department, and Mrs. Gerald has been transferred to the Lone Star stores department.

J. H. Hodges, formerly employed as district manager at Pauls Valley, Okla., for the Community Natural Gas Co., has been transferred to Sulphur, Okla., where he relieves C. L. Slover as manager of the Sulphur district. Walter Harris, formerly Wynnewood, Okla., district manager, replaced Mr. Hodges at Pauls Valley, and W. C. Gibson, former fitter and service man at Wynnewood, has succeeded Mr. Harris as manager of that district.

W. M. Little in Charge of New Dept. for Ark. Natural Gas Corp.

ARKANSAS Natural Gas Corp., Shreveport, La., announces the consolidation of the gas distribution operating departments of its several subsidiaries with headquarters in Shreveport. The new department will be headed by W. M. Little as superintendent. Mr. Little has been general superintendent of gas distribution properties of the company in Arkansas for about two years, going to Little Rock from Cities Service headquarters in Bartlesville, Okla. Cities Service interests acquired the properties of Arkansas Natural Gas Co. in 1928, later purchasing also the Southern Cities Distributing Co., serving natural gas in northern Louisiana and eastern Texas, and Mr. Little will be in charge of the company's distribution properties in the three states.

W. M. Little

Scottsville Gas Co. Asks Franchise

Scottsville Gas Co., Scottsville, Ky., has asked for a franchise to serve natural gas in Lebanon, Ky., supply to come from gas fields near Scottsville.

Montana Power Co. Advertises "Natural"

WITH the coming of natural gas into the territory served by Montana Power Co., Butte, Mont., gas sales activities of the company have increased under the direction of W. H. Barton, manager, Natural Gas Division, and Len Rausch, sales manager of the division. Mr. Rausch sends *Western Gas* the accompanying photograph of a billboard which attracted much favorable attention during the past few months.

The entire board is 70 feet by 15 feet, the lettering and pictorial being large enough to read at some distance by motorists passing on the Anaconda-Butte road, as well as by passengers traveling between those two points on the Northern Pacific. At the top of the last hill before reaching the city of Butte a neon sign in brilliant red letters conveys the message of "Natural Gas" to the world. At one side of the board is a pictorial showing a man and woman seated on a sofa in front of a fireplace containing a lighted radiant-type heater, the lighted effect being achieved by an orange neon tube. The words "Comfort in the Home" and on the other side "for Every Heating Need" emphasize the comfort and utility of natural gas heat.

P. G. and E. Gains Told in Annual Report

PACIFIC Gas and Electric Co., San Francisco, recently brought from the press its Twenty-Sixth Annual Report, covering the 1931 fiscal period. The report reveals a net gain in gas sales of 17,946,196,000 cubic feet during the past 10 years, with 11,483,551,000 cubic feet sold in 1921 as compared with 29,429,747,000 in 1931. Net gain in number of gas consumers during the same period was 218,899. At the close of 1931, the company had 516,169 customers for its gas service, a gain of 9,316 for the year, and a total of 7,152 miles of gas transmission and distribution lines.

Gross operating revenue for the 1931 period was $87,630,661, a gain of $1,997,520 over 1930, and the gain in net income was $2,075,685 for the same period. Operating expenses showed a substantial decrease. The gross operating income of the gas department was $998,363.

Sales of gas on the entire system of the Pacific Gas and Electric Co. and its subsidiaries totaled 29,429,747,000 in 1931, an increase of 6,351,711,300 cubic feet over any previous year. The volume of natural gas transported through the two main trunk lines of the company increased from a daily average of 50,700,000 cubic feet in December, 1929, to 108,800,000 cubic feet in December, 1930, and to 154,821,000 cubic feet in December, 1931. Drilling operations by the company in Kettleman Hills area resulted in the completion during 1931 of 26 producing wells with a combined initial output exceeding 600,000,000 cubic feet of gas daily.

Sale of General Utilities Co. Properties on May 31 at Kansas City

James B. Nourse, trustee in bankruptcy for General Utilities Co., was scheduled to receive sealed bids on May 31 for the purchase of the following sudsidiaries of the company: Moline Gas and Service Co.; Plattsburg Gas and Service Co.; Marion Gas and Service Co.; Herington Gas and Service Co.; Council Grove Gas and Service Co.; Peabody Gas and Service Co.; Florence Gas and Service Co.; Hillsboro Gas and Service Co.; Consumers Gas and Service Co.; Public Gas and Service Co.; Kaw Valley Gas and Service Co.; Liberty Gas and Service Co.; Smithville Gas and Service Co.; Suburban Gas and Service Co.; Bonner Springs Gas Corp.; Arrow Oil and Gas Co.; Arrow Pipe Line Co.; Odessa Gas and Service Co.; Cameron Gas and Service Co. and Lathrop Gas and Service Co.

North Central Gas Co. Reported Planning New Compressor Plant

North Central Gas Co., Casper, Wyo., is reported planning construction of a compressor station at Guernsey, Wyo., if sufficient demand is added to the lines for the winter load. The company plans to add several towns to its systems this summer if franchises are granted. Applications have been filed in Alliance and Sidney, Neb., and other towns along the route of the reconditioned oil carried which transports the company's gas supply.

Illinois Northern Utilities Now Owned by Commonwealth Edison

Announcement was recently made of the purchase of Illinois Northern Utilities Co., controlled by Middle West Utilities Co., Chicago, by the Commonwealth Edison Co. Illinois Northern operates 14 gas properties. The Commonwealth Edison Co. has no gas properties other than those owned by Illinois Northern. According to E. D. Alexander, president of Illinois Northern Utilities Co., there will be no changes in personnel or operating set-up.

Change Taylorville-Pana Lateral Line Route from Main Carrier

The route of the Panhandle Illinois Pipe Line Co.'s lateral from the main line to Taylorville and Pana, Ill., has been changed. As now planned, the line will approach Taylorville on the east side of the town, where a high pressure line of Central Illinois Public Service Co., extending from Taylorville to Pana, is located. The new lateral will be approximately 15 or 20 miles long.

Determining Heating Value of Fuel Gases

By GUY CORFIELD
*Chief Chemist, Los Angeles Gas and Electric Corp.**

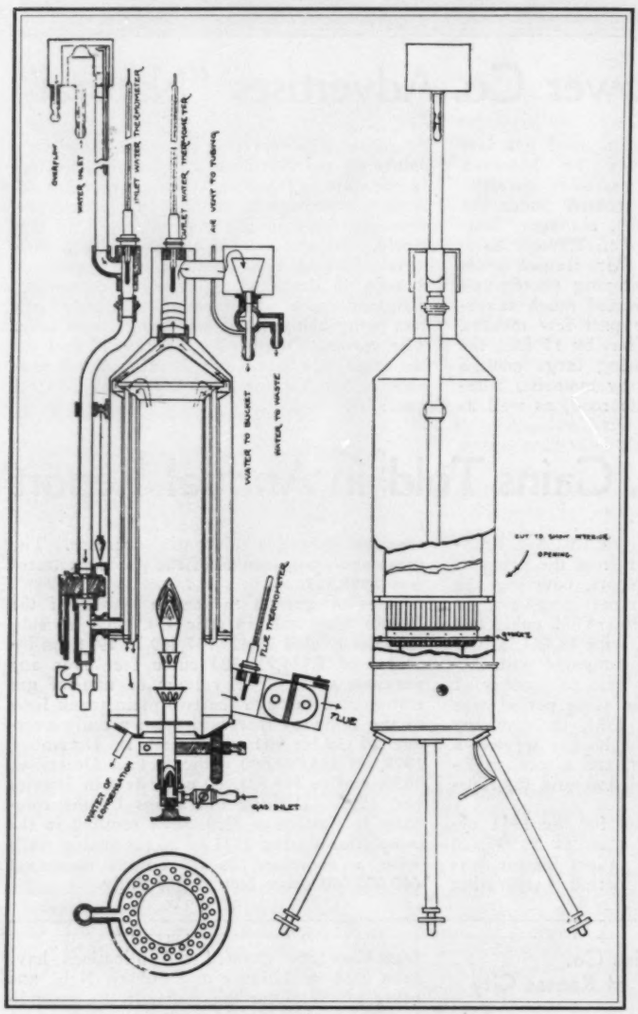


Fig. 1. Construction details of laboratory calorimeter.

INASMUCH as fuel gases are distributed and purchased solely for the purpose of utilizing the heat they can deliver when burned, it is interesting and useful for everyone connected with the gas business to possess some fundamental information as to the amount of heat gases contain and the methods available for determining this heat content.

The unit of heating value is the B.t.u., an abbreviation for British thermal unit, and is the amount of heat which will raise 1 pound of water 1 degree Fahrenheit when the atmospheric pressure is 30 inches of mercury. The Total Heating Value of a gas is the number of B.t.u. produced by the combustion, at constant pressure, of 1 cubic foot of the gas measured at 60° F. and 30 inches of mercury, saturated with water vapor, with the combustion air at the same temperature and pressure as the gas, the products of combustion cooled to the initial temperature of the air and gas and all the water vapor formed by combustion condensed to liquid water. We will see later that it is comparatively easy to comply with all these seemingly exacting conditions, and to make this determination with great precision.

The Total Heating Value of a gas is often called the Gross Heating Value, to distinguish it from the Net Heating Value. An explanation of these two heating values, Total or Gross, and Net, is as follows: When hydrogen gas itself, or any gas containing hydrogen, such as methane or ethane, burns, water vapor is formed by union of the hydrogen with atmospheric oxygen. We will remember from our physics that when water is converted into steam, or water vapor, at or above 212° F., heat will be absorbed during the process in the amount of 970.4 B.t.u. per pound of water. This heat is called the Latent Heat of Vaporization. Therefore, if the combustion products are discharged into the atmosphere above 212° F., as is the case with steam boilers and industrial furnaces, this latent heat is carried away and lost, together with the heat required to raise the amount of water involved from the inlet gas and air temperature of 60° F. to 212° F. The Net Heating Value, then, is less than the total or Gross Heating Value by the amount of heat lost because of uncondensed water vapor, which in turn is proportional to the hydrogen in the fuel. Hence this loss is commonly called the Hydrogen Loss of a fuel. It is quite appreciable. For instance, a mixture of 10 per cent ethane and 90 per cent methane has a total or gross heating value of 1100 B.t.u., and a net heating value of 988 B.t.u. Therefore, approximately 10 per cent of the total heat is unavoidably lost if the stack temperature of a boiler or furnace burning natural gas is above 212° F.

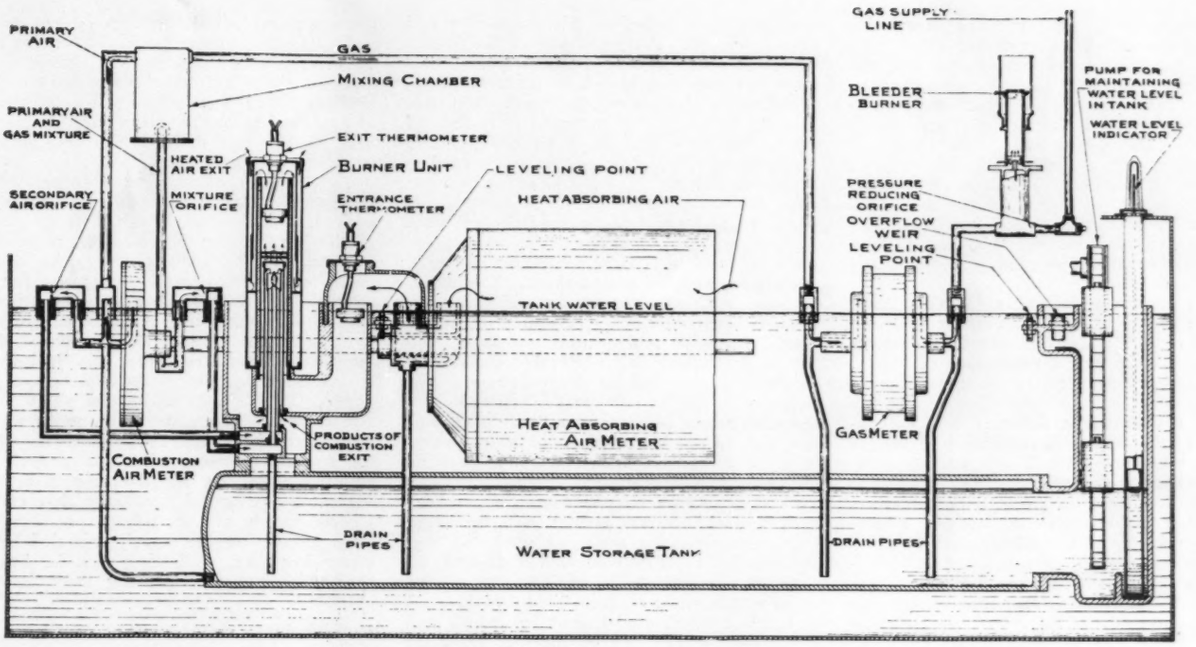
As the heating value of a gas depends on the proportions of noncombustible and combustible constituents contained in it, and the nature or composition of these combustible constituents, an analysis of the gas affords a means of calculating the heating value. A complete and exact gas analysis, however, is a long and difficult procedure to go through, whereas the B.t.u. determination such as will be described shortly, is relatively easy, rapid and very accurate, and therefore always employed when only heating value is required.

Fig. 1 shows the construction details of a typical laboratory gas calorimeter, which is essentially a device whereby and wherein a measured amount of gas is burned and the heat completely absorbed by a measured amount of water which is thereby raised a measured number of degrees. The water enters the inlet tube, passes around the inlet thermometer bulb, down and through a flow regulating valve and into the calorimeter proper. Here the water circulates around the outside of a number of tubes through which pass the products of combustion and from which the heat is absorbed. The water emerges from the top of the calorimeter, passes around the outlet thermometer bulb and through a three-way valve whereby, during the actual test, it can be diverted into a bucket and weighed. The gas, measured as to volume, temperature and pressure, is burned with a perfect blue flame by the burner which discharges the heated combustion products up the center of the calorimeter, down through the tubes about which the water circulates, and out through the flue. A thermometer and a damper in the flue allows the draught, or combustion products movement, to be so regulated as to be completely cooled. Note the metallic rings on the vertical barrel of the burner, so placed as to prevent heat from being radiated downward and outward. The heat absorbing efficiency of a calorimeter of this type is above 99.6 per cent. The condensed water from combustion of hydrogen collects and is discharged from the bottom of the calorimeter body and can be collected and measured and affords a means of calculating net heating value.

Guy Corfield

A typical laboratory test assembly with accessory equipment consists of a gas meter, pressure governor, calorimeter and burner, and scales for obtaining the weight of water. The gas meter used is commonly called a "wet test" meter, for the reason that the metering principle is that of a partitioned drum submerged about two-thirds and revolving in water. This meter can be calibrated and read to an accuracy of three-tenths of 1 per cent, and is provided with

*Presented before the Southern California Meter Association, April 28, 1932.



thermometer and pressure gauge. It also serves as a saturator if the gas is not already saturated with water vapor. By means of the meter temperature and pressure and a barometer reading, the gas volume can be calculated to the corresponding volume under standard conditions of 60° F. and 30 inches of mercury. The thermometers are calibrated by the Bureau of Standards, corrected for exposed mercury thread and can be read to 1/100 of 1 degree. The water is weighed to the third decimal place in pounds. Radiation from the calorimeter jacket is negligible if this jacket be kept polished. The inlet water is maintained at the same temperature as the room by having it come from a tank in the ceiling rather than direct from the faucet. If it deviates markedly from room temperature a correction is applied. The humidity of the air in the test room is determined by a psychrometer so that a correction can be made to compensate for the water vapor carried out of the calorimeter flue. Thus every contributing and upsetting factor is taken care of by a simple observation or calculation. The actual figure for B.t.u. is obtained by multiplying the pounds of water by the temperature rise and dividing by the cubic feet of gas burned during test, all factors being corrected as already shown. An experienced operator can easily determine and duplicate results with an accuracy of one-third of 1 per cent and a single test does not take longer than 10 minutes in its entirety if the apparatus is kept in good condition.

Fig. 2 (Above)

Arrangement of piping and meters for Thomas calorimeter.

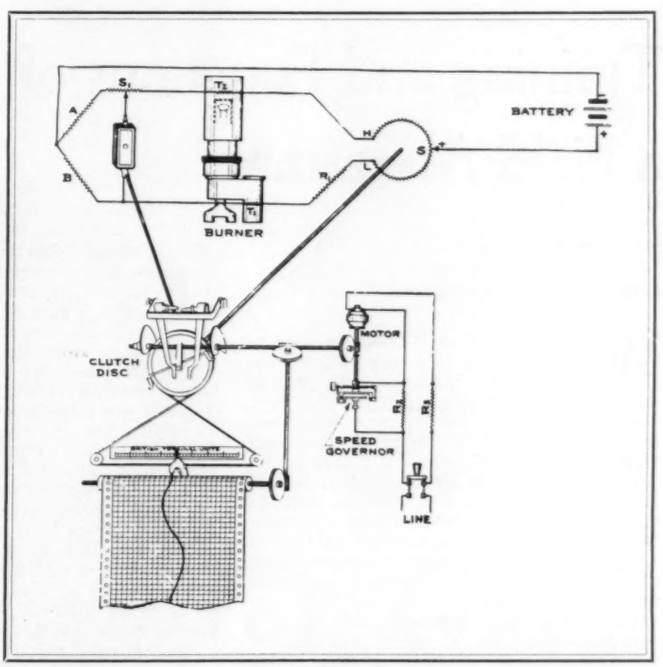


Fig. 3 (At Right)

Wiring arrangement of Thomas calorimeter.

Recording Calorimeters

Several recording calorimeters are now on the market. To the writer's knowledge the only type in use in this area is the one that will now be briefly described, the Thomas Recording Calorimeter. Fig. 2 shows the arrangement of piping and meters for the measuring unit of this instrument. The general principle involved is the combustion of a constant quantity of gas in a constant quantity of air, the heat being absorbed by a second constant quantity of air and the temperature of this air measured, before and after heat absorption, by electric resistance thermometers. The difference in temperature of these two electric resistance thermometers is transformed into registration by an electrical device that will be described later. The gas meter (near the right), the combustion air meter (at the left) and the heat absorbing air meter (center) are all rotated slowly by the same motor. They are about two-thirds submerged in water and are of the "wet meter" type, the gas or air being moved through them in constant amount by virtue of the rotating motion and water level and water-seal effect. Gas from the gas meter and air from the combustion air meter are mixed in the mixing chamber and burned in the burner unit. Air from the heat absorbing air meter passes across the entrance thermometer (cold) and up through the burner, picking up the heat and registering it by contact with the exit thermometer (hot). Thus a difference in temperature is created which corresponds to a definite gas B.t.u. As gas is burning in constant quantity the only thing that will increase or decrease this difference in temperature will be an increase or decrease in B.t.u. All other influences are automatically eliminated. The three meters are at the same temperature because they are revolving in the same water bath. If the water becomes cooler or hotter the gas and air will be affected alike as both obey the same laws of expansion or contraction. The same applies to variations in barometric pressure. If there is a variation in the speed of the three meters it will affect all three alike, as they are all driven from the same motor. Both gas and air are saturated with water at the

same temperature. The variable that is introduced by the changing water vapor content of the gas due to temperature and the changing specific heat of water saturated air from the same cause is taken care of by making the resistance thermometers of nickel wire which has a temperature characteristic that compensates for the combined error of these two variables. Therefore it is only necessary to pass a gas of known B.t.u. through the instrument and arbitrarily set the recording unit to read this known B.t.u. The instrument is then ready to record any gas desired.

Fig. 3 shows the wiring arrangement and the connections between measuring unit and recording unit. T_1 is the entrance thermometer and T_2 the exit thermometer of Fig. 2. These two electric resistance thermometers are connected in the electrical system as two legs of a Wheatstone Bridge. The galvanometer of this bridge is ingeniously arranged so that when unbalanced will tend to actuate mechanical movements that revolve a wheel called the clutch disc which, in turn, rebalances the Wheatstone Bridge. Therefore any change in the relative difference in temperature between entrance and exit thermometers, due to a change of B.t.u. of gas, will immediately unbalance the bridge and cause a movement of the clutch disc one way or the other until balance is restored. The pen that writes on the recording chart is mechanically attached to this clutch disc and moves with it. Any position of the clutch disc represents a definite thermometer balance and therefore a definite B.t.u. and is so indicated by the pen on the chart. The pen writes, therefore, a continuous record of B.t.u., faithfully indicating all changes and fluctuations. The chart can be easily read to 5 minutes of time and 2 B.t.u.. and is changed once a month. The record is accurate to one-third of 1 per cent, or about 3 to 4 B.t.u. in 1100, and the instrument can be kept in good adjustment with a relatively small amount of care and maintenance. The maintenance consists of periodic checking against a laboratory calorimeter, cleaning of water tank, lubrication and general inspection, and should be regular and preferably daily. On the basis of considerable experience with this instrument the writer would estimate that one instrument requires about one man hour per day, when considering all work necessary for its maintenance and good operation over a period of years.

The only connection between the recorder unit and the meter, burner and thermometer assembly, is a series of wires, so that the two units can be separated if desired, although convenience in maintenance makes it desirable to have them side by side. A second recorder can be installed which can be located at any desired distance from the primary units.

Training and Functions of a Field Meterman

By E. E. Stovall

*Lone Star Gas Company**

WE HAVE found it good practice to start the meter inspector in the office, acquaint him with the procedure of that particular part of the department's work and let him study the various meter handbooks for a few days. He is thus in direct contact with men who understand the theory and the principle of each instrument that is used in gas measurement and that he will be called upon to take care of when he is a full fledged meter inspector. This has a tendency to get him gas measurement- or meter-minded more quickly than any other method.

Like most other companies, we have a shop maintained at our central headquarters for the purpose of overhauling, making minor repairs, etc., to all types of meters, regulators, gravitometers and numerous other instruments that are used in gas measurement. This is the next place the new recruit goes to further his gas measurement education. Usually in employing a new meter inspector we have some definite branch of the work, orifice meter inspection, in mind for him, and naturally we concentrate on that particular line of the work in his preliminary training.

Our shop foreman is familiar with all the different phases of the work carried on in the shop, and is capable of showing the newcomer all that is necessary for him to grasp in order to make of himself a proficient and active meter inspector. Naturally the beginner is placed on a job that does not require particular skill to begin with, such as taking the instruments apart that have been sent in for repairs, noting as he does so just what part each part of the instrument plays in its operation. Step by step the apprentice is given more opportunity to overhaul, repair and calibrate the instruments until he has finally grasped the fundamental principles of gas measurement and the operation of meters and regulators. When the shop foreman advises us that the apprentice has grasped the required amount of knowledge of the work, we feel that we can depend on him to go out and take charge of a district. However, before he is sent out he is brought back to the office for a few more days study of the office routine and particularly of the charts coming in from the district in which he is to be placed. We have one district known to us as the West Texas District, around Ranger and Breckenridge, to which we usually send our beginners. Six or eight meter inspectors are required to properly handle the work in this particular district, under the direction of a supervisor. By placing a new recruit under this supervision, in charge of a certain number of meters in that district, he has expert advice available on any phase of the work that is not perfectly clear to him.

Our meter inspection procedure has been reduced to a definite schedule followed month by month. Each orifice meter is tested thoroughly once each month as to correctness for static pressure, differential zero position, sensitivity of the instruments, leaky meter piping and other minor tests that the inspector may deem necessary; and at least once every three months the meter is tested for its correctness by a calibration both of the static and the differential throughout the meter range. Each time the meter inspector makes either of the above tests a report of his findings is sent to our general office on a form drawn for that purpose. Meters which have charts placed on them daily are tested daily by the chart changer for the correctness of the differential at zero, and where the charts are placed only once each seven days a like test is made twice during that period.

Usually the orifice meter inspector has other duties assigned to him, such as the care and testing of gravitometers, air recorders, recording thermometers; at least once every six months a gravity test is taken on each field well meter; and for our convenience we may have him test a few of our sales or main line check meters once or twice a month. Every chart removed from the meters that are under his jurisdiction is inspected by the meterman before they are mailed to the office, and if for any reason the records made by the meter on any particular chart are incomplete, he places the necessary information for proper calculation either on the chart or attaches a letter explaining the conditions that existed. Charts which are in proper condition for office calculating are merely initialed by the meter inspector, indicating that he has inspected them before mailing them into the office.

Positive Meter Inspectors

The duties of a positive meter inspector vary slightly to those of an orifice meter inspector. A thorough test is made on each positive meter in active service at least once every three months unless conditions warrant a test more often. Incidently on meters where it is possible we are using the critical flow method for testing, and where the pressure is not sufficient for us to use this method, we use a No. 3 Emco test meter for test purposes. Ususally a positive meter inspector has only positive meters to take care of in his district. Likewise, the positive meter inspector also inspects any charts removed from the meter before they are mailed to our office for calculation.

Although a meter inspector is not necessarily considered an office man, he is sometimes called upon to do quite a bit of office work in conjunction with his other duties. For instance, on orifice meters the meter inspector is required to fill out and mail to the general office a complete report as to the connection or disconnection of a meter, attaching also a sketch showing the actual location and conditions existing at this installation relative to other installations in that locality. He also keeps a record of all installations showing the meter number, the location, the date of the meter test, the results of the test, the date and the results of each gravity test made. Where there are several chart changers under one meter inspector's jurisdiction, he is required also to keep and report the chart changers' time along with his own to the general office. Practically the same requirements are made of positive meter inspectors, with the exception of making a connect and disconnect report of their meters. This work is usually done by the field foreman in that particular district. However, each time that a positive meter is set or removed, the field foreman advises our meter inspector to that effect. Recently we have required that a report be attached to the time sheets at the end of the month giving in detail the total number of meters that were tested and the total number not tested during the preceding month, with full explanation as to why certain meters were not tested. We have found this to be a very good policy in that it eliminates a possibility of overlooking the test of a meter for any great length of time. Every three months our meter inspectors are requested to send in a report covering a list

(Continued on Page 54)

* Excerpts from a paper presented before the Southwestern Gas Measurement Short Course, Norman, Okla., April 26-28.

Gas measurement men from 18 states participated in 1932 sessions of the Southwestern meter short course.

235 Register for Southwestern Meter Short Course

EIGHTEEN states, extending from the Pacific to the Atlantic, were represented at the Southwestern Gas Measurement Short Course at Norman, Okla., April 26, 27 and 28. Registration reached 235. The short course was conducted by the College of Engineering, University of Oklahoma at Norman, assisted by the Corporation Commission of Oklahoma, Oklahoma Utilities Association, Natural Gas Department of the American Gas Association and Natural Gasoline Association of America. B. L. Maulsby, Oklahoma Natural Gas Corp., Tulsa, was chairman of the general committee, made up of representatives from the University and various gas and oil companies.

W. R. McLAUGHLIN

Elected as chairman of the general committee to arrange details for the Southwestern Gas Measurement Short Course in 1933.

Representatives of several gas equipment manufacturing companies were present with exhibits. The classes were conducted by members of the engineering faculty, assisted by gas utility and gas equipment representatives. All sessions were held in the Engineering Building. The course included addresses, instruction and demonstrations on matters connected with measurement of natural gas and natural gasoline, and principles, repair and testing of various types of meters. A banquet was held in the McFarlin Church on the second night, featuring talks, stunts and other entertainment. W. R. McLaughlin of the Arkansas Natural Gas Corp., Shreveport, Louisiana, was selected as chairman of the general committee to cooperate with the university in arranging the short course next year.

S. C. M. A. Forum of Experience

"Knowledge is built upon the experience of others."

Previous Questions Answered

A. 125. The gravities yielded by specific gravity recorders and gas gravity balances check very closely. However, the recorder should be lubricated by a heavy oil or vaseline instead of the usual fibre grease supplied.

A. 126. A straight nipple and a gate valve screwed into the orifice fitting or line may be cleaned without a shutdown. It is necessary to break the pipe to the gate valve and then install a stuffing box with a small drill, and clean out scale.

A. 127. Flange taps and line taps, (2½ diameters and 8 diameters) are used entirely in gas measurement work. Throat taps, and vena contracta taps, are extensively used in steam measurement and water plant works. There are also several other tap spacings which are used. Each requires its own set of coefficients to compute fluid flow.

A. 128. If a gas pressure regulator is installed near a fluctuating load outlet, it will undoubtedly cause a fluctuating orifice meter record. The orifice meter differential pen will have to fluctuate in order to measure the fluctuating load. However, the writer of this question more probably is concerned, not with the normal fluctuation due to load changes, but with a smeared and jumpy line due to a jumpy, sensitive regulator which is attempting to function as it is supposed to. A regulator that is too sensitive and too responsive to slight pressure changes, is not adapted to this service. It is necessary to make a compromise between pressure regulation and flow control, by means of a regulator which is not too sensitive.—R. F. A.

S. C. M. A. May Meeting One of Year's Best

C. E. PICKUP of the Southern California Gas Co. and K. C. Tomlinson of the Pacific Meter Works headed one of the most interesting programs of the year for the Southern California Meter Association, at the meeting of May 26, held in Whittier, Calif. at the English Tavern. Mr. Pickup's paper dealt with "The Effects of Ambient Temperatures on Gas Measurement," and treated a series of tests conducted by the author in the Kettleman Hills field. Mr. Tomlinson described "The Metric Wide Range Orifice," recently developed, and displayed one of the new fittings in connection with his paper.

P. W. Hill, president of the S. C. M. A., called the business meeting to order after an excellent dinner. Announcement was made of the results of the Association's last monthly golf tournament won by W. A. Spencer of the Southern Counties Gas Co. The new S.C.M.A.-*Western Gas* Goodfellowship Trophy was given into Mr. Spencer's keeping for one month.

E. Lorenz introduced Frank Fields and W. E. Sharp of the Southern California Gas Co. and described a direct reading water column for checking square root chart readings, developed by these men. A working model was on hand, and a check was made of readings on a Westcott pressure and differential gauge. A description of this water column, as well as the papers by Mr. Pickup and Mr. Tomlinson, will appear in an early issue.

Martin J. Insull Resigns Post

Martin J. Insull has resigned as president of Middle West Utilities Co., Chicago, on account of ill health. His successor has not been named.

George Merkle Appointed to Post in So. Cal. New Business Dept.

George Merkle, salesman for the San Bernardino District office of the Southern California Gas Co., has been transferred to the new business department at Los Angeles headquarters. Mr. Merkle's place at San Bernardino will be taken by William Snyder.

Geneseo Water Treating Plant

Natural Gas Pipe Line Co. of America, Chicago, Ill., is beginning construction of a water treating plant at the Geneseo compressor station at Geneseo, Ill.

J. J. Brennan Heads Southern Gas Ass'n

J. J. Brennan

S. L. Drumm

THE 24th Annual Convention of the Southern Gas Association, held at the Monteleone Hotel in New Orleans, La., was reported one of outstanding merit, with approximately 200 delegates attending. J. J. Brennan, industrial gas engineer of Memphis Power & Light Co., Memphis, Tenn., was elected to succeed E. N. Avegno of New Orleans Public Service Inc., as president of the association for the coming year. Serving with Mr. Brennan are B. B. Ferguson, Portsmouth Gas Co., Portsmouth, Va., as vice-president, Edmund S. Dickey, Maryland Meter Works, Baltimore, Md., second vice-president, and S. L. Drumm, industrial gas engineer, New Orleans Public Service, Inc., secretary-treasurer. The 1933 convention city will be chosen at the first session of the Executive Committee.

General Sessions were in direct charge of E. N. Avegno, the president, and were held each morning of the three days, while the afternoons were given over to meetings of the various sections of the Association. Meeting jointly with the Commercial-Industrial Sections, the Southern Regional Sales Conference of the American Gas Association was held. The Technical Section scheduled two afternoon meetings. The Industrial Section was headed by J. J. Brennan as director in charge, and Chas. Rogers, chairman. Technical Section meetings were under the direction of B. B. Ferguson, director in charge, and Harold L. Gaidry, chairman; and the Commercial Section was under the leadership of Jack Owen, director in charge and Robert C. Anderson, chairman.

Entertainment features included a grand ball, cabaret banquet, golf and tennis, as well as special events for visiting ladies. A. E. Merchant, New Orleans Public Service Inc., was chairman of the entertainment committee, assisted by Mrs. A. E. Merchant, chairman of the hostess committee.

Directors chosen for the 1932-1933 period include C. E. Dougherty, Chattanooga, Tenn.; J. Albin Johnson, Birmingham, Ala.; J. W. Owen, Winterhaven, Fla.; Geo. Park, Meridian, Miss.; C. B. Gamble, Birmingham, Ala.; J. F. Orr, Houston, Texas; W. L. Plummer, Atlanta, Ga., and C. M. Rogers, New Orleans, La.

Longitudinal Movement of Pipe

(Continued from Page 23)

vertical arches. To provide this 5.5 inches in 1,000 feet (without going through an involved calculation) we may say theoretically that if two arches 3 feet high are provided every 1,000 feet, this 5.5 inches will be amply taken care of. As soon as these slack loops settle, there will be no danger of them pumping themselves out of the ditch. This initial temperature change is very important, for while its effect is felt for only a slight period of time, yet due to the large change in temperature at this time, it is here that the most trouble will occur. If this factor is neglected and the line laid at this high temperature, upon cooling to normal ditch temperature it will tend to shorten approximately 5.5 inches per 1,000 feet, while the normal contraction and expansion after the pipe assumes ground temperature will be only approximately 3.2 inches per thousand feet.

For a solid welded line laid straight, it can be seen that the total stresses set up by contraction would tend to shorten the line in the neighborhood of 8.7 inches, while after the first drop in temperature the tendency to shorten would be only 3.2 inches. This tendency, providing the pipe were not able to move, would evidence itself as tensile stresses of 14,000 lbs. and 8,000 lbs., respectively. (See Fig. 1.) This lower figure is well below the elastic limit of steel and would not cause any serious trouble, except that under certain conditions of strain there would be a possibility of the gate valve flanges being broken.

It will be noted in the foregoing statement that the factor of soil adherence has been neglected and while this would undoubtedly affect the movement of the pipe, yet definite information at the present on this is so slight that one fears to state to what extent it will enter into the relationship.

Table No. 2 gives a theoretical comparison of the two methods of obtaining the approximate necessary slack based on a length of 1,000 feet of pipe.

The table assumes that couplings below 12-inch will allow ¼-inch movement, while those 12-inch and over will allow ½-inch movement. It is further assumed that each slack arch will provide approximately 2.25 inches slack in a 3-foot ditch.

The necessary slack can be obtained through arching the line in the smaller sizes or by a combination of both arches and couplings in medium sized lines. For the larger lines it is impractical to obtain slack in the ditch and the result desired is better accomplished through the use of couplings.

TABLE NO. 2—SLACK PER 1,000 FEET OF LINE BASED ON 2¼ INCHES PER LOOP.

Temp. Differ.	All Sizes less than 12 Inches		All Sizes 12 Inches and over	
	Slack by Ditch.	Slack by Coupling	Slack by Ditch.	Slack by Coupling
40°F	1.5 Arches	13 couplings	1.5 Arches	6 couplings
50	1.9 Arches	16 couplings	1.9 Arches	8 couplings
60	2.1 Arches	19 couplings	2.1 Arches	10 couplings
70	2.5 Arches	21 couplings	2.5 Arches	11 couplings
80	2.9 Arches	25 couplings	2.9 Arches	13 couplings
90	3.2 Arches	29 couplings	3.2 Arches	14 couplings
100	3.5 Arches	32 couplings	3.5 Arches	16 couplings
110	4. Arches	35 couplings	4. Arches	17 couplings

Contract Let on So. Counties Section of San Diego Line

Construction operations are well under way on the 12¾-inch line to take natural gas to San Diego, Calif. Contract has been let by Southern Counties Gas Co. to Lindgren & Swinerton, Los Angeles contractors, for laying 44 miles of 12¾-inch line from a point 6½ miles south of the northern boundary of the city of San Diego to the boundary line between San Diego County and Orange County. The portion north of the Orange County line is being constructed by crews of Southern Counties Gas Co., while Industrial Fuel Supply Co. is building 10.5 miles of 16-inch line to tie in with Southern Counties line at Huntington Beach. San Diego Consolidated Gas and Electric Co. is taking the line from Rose Canyon into the city distribution system.

The State Railroad Commission has approved a contract between San Diego Consolidated Gas and Electric Co. and Southern Counties Gas Co. whereby the former will purchase from the latter company natural gas for resale on its system.

The contract calls for a delivery of approximately 24,000,000 cubic feet of natural gas daily delivered at San Diego.

The price to be paid for the gas is 30 cents per thousand cubic feet for all gas used for domestic and commercial consumers and 12 cents for all gas used for fuel and industrial consumers.

The city of Escondido, Calif., plans to take action for securing a supply of natural gas. In order to bring natural to Escondido it would be necessary to construct a 20-mile lateral from the new main carrier. Oil gas is now being served by San Diego Consolidated Gas and Electric Co. in the Escondido district.

Appalachian Gas Corp. Is in Receivership; Plans Reorganization

Three receivers have been named for the Appalachian Gas Corp., New York, holding company for gas properties throughout the United States, including the Memphis Natural Gas Co., Memphis, Tenn., Texas Gas Utilities Co., Del Rio Texas, and Monroe Consolidated Gas Co. Elwyn Evans of Wilmington, Delaware; Arthur B. Coontz, Charleston, W. Va., and O. H. Simonds of Glen Ridge, New Jersey, have been named receivers. Receivership proceedings have been initiated to make possible reorganization of the company, with a committee formed to protect the interests of stockholders.

Delegates assembled in the Annual Convention, Natural Gas Department, A. G. A., held at Tulsa, Okla., May 9-11.

Natural Gas Men Close 1932 Convention Sessions

WITH Tulsa, Okla., as their mecca, members of the Natural Gas Department of the American Gas Association gathered in Annual Convention May 9-11 to discuss problems uppermost in the industry at the present time.

Convention plans were in the hands of T. J. Strickler, vice-president, Kansas City Gas Co., and chairman of the Natural Gas Department; A. E. Higgins, secretary of the Department, and E. A. Olsen, president of Oklahoma Natural Gas Corp., and chairman of the General Arrangements Committee.

More than 600 members and friends of the Department, of whom approximately 450 were registered, attended the sessions, for which a program of unusual merit had been scheduled by the program committee, chairmaned by H. C. Morris, president and general manager of the Dallas Gas Co.

In addition to the general sessions, an interesting program of entertainment was worked out by William B. Way, general manager of the International Petroleum Exposition and Congress and chairman of the Convention Entertainment Committee.

Selection of the convention site for 1933 was placed in the hands of the Time and Place Committee, which will bring in its report at the Annual Convention of the American Gas Association at Atlantic City in October.

To Spend $165,000 in Gas Main Extensions in San Antonio

San Antonio Public Service Co., San Antonio, Texas, announces that a construction budget of the company for the remainder of the present year contemplates the expenditure of approximately $463,000. Of this amount it is estimated that $165,000 will be expended in the gas department for main extensions and new services.

Galston Plans $1,000,000 Line from Brownwood to Lampasas

Ray D. Galston of Tyler and associates have recently completed a survey for a proposed natural gas main line from Brownwood, Texas, to Lampasas. Approximate cost of the line would be $1,000,000 and if the project is put through, Mr. Gaston expects the line to be ready for service by winter.

St. Louis County Gas Co. Reports Good Water Heater Load

A recent survey conducted by the St. Louis County Gas Co., Webster Groves, Mo., shows that 23 per cent of all the homes on the company's system are equipped with automatic gas water heaters, and that in one community supplied by the company, 13 per cent of all the homes that are occupied by the owner have automatic gas heating equipment.

Ask Permit to Operate Pella-Knoxville Gas Transmission Line

May 31 was the date set by the Iowa Railroad Commission for a hearing on Central States Electric Co.'s petition to operate a gas transmission line between Pella and Knoxville, Iowa. Supply would come from the main line of the Natural Gas Pipe Line Co. of America.

Circus Ballyhoo is Campaign Keynote

(Continued from Page 25)

tainment and fun characterized the event.

Each salesman received a campaign prospectus—a large size (11 by 15 inches) booklet which carries the head line "The Big Show Comes to Town" and presents details of the plan for the three months campaign. The brochure is printed on brilliant yellow heavy paper, and is consistently executed to carry through the circus atmosphere. The slogan "Ride on the Top of the Wagon," is featured. The cover represents a lion's cage, the front of the cage being cut out with the lion, pasted on the first page of the inside, gazing out from behind bars painted on cellophane. Inside are brilliantly colored cut-outs of modern design of the various circus performers,—clowns, elephants, donkeys, etc., accompanying a page-by-page description of the "Big Show" campaign, and manufacturers literature.

Prizes for the most successful sales efforts are awarded on the basis of credits obtained —three credits being given for each $5 in merchandise sold. Additional credits offered include 50 for each refrigerator sold, 50 for each water heater sold, 75 for each room heater of over 30,000 B.t.u. input capacity, and 150 credits for each househeating job sold, either warm air furnace, boiler or conversion burner. Prizes include cash and valuable merchandise. The standing of the salesmen is printed in the "Sales Bull," company sales pamphlet.

That the campaign is succeeding is evidenced by the fact that sales have doubled each week since the meeting.

Leaberry Gas Co. Buys 28,000 Acres in Big Sandy Valley

The Leaberry Gas Co., operating in Kentucky, with Harry Leaberry, Baltimore, Md., as president, took over 28,000 acres of proven gas territory in the Big Sandy Valley, Ky. The territory has open flow production amounting to 62,000,000 cubic feet daily. Undeveloped acreage in the tract will be developed by the company, the supply being destined for eastern markets.

Asks Payette Franchise

Louis Lilly has filed application with the Idaho Utilities Commission for permission to serve natural gas in Payette, Idaho. Supply would come from wells near the town.

Foreclosure on Bourbon Pipe Line Properties in Kansas and Missouri

Foreclosure proceedings are reported to have been filed against the Bourbon Pipe Line Co. of Rich Hill, Mo., by Louis C. Cyr. The foreclosure involves the company's properties at Rich Hill and Hume, Mo. It is reported that Mr. Cyr plans to take over the properties and operate them.

Executive Conference on Calendar for A. G. A. Officers

An Executive Conference is scheduled to be held at the Traymore Hotel in Atlantic City, N. J., June 3 and 4, with officers and directors of the American Gas Association in attendance.

BUTANE - PROPANE NEWS
Covering Liquefied Petroleum Gas Service

Specifications for Commercial Propane and Butane

By T. W. LEGATSKI*

THE subject of specifications for liquefied petroleum gases can best be approached by first considering the various fields of utilization and the demands which each of these place upon the products. Obviously, any specifications which are placed upon products must of necessity serve to exclude those products which experience has dictated will prove to be unsatisfactory. Specifications should also of necessity be lenient enough to allow all satisfactory products to be readily marketed.

The commercial liquefied petroleum gases as manufactured in the natural gasoline industry can for all practical purposes be considered as being composed of propane, iso-butane and normal butane, although small percentages of ethane and pentanes are invariably present in some of these products. The mode of manufacture does, however, preclude the occurrence of either of these two last mentioned hydrocarbons in appreciable amounts. Liquefied petroleum gases being a by-product of natural gasoline are necessarily somewhat variable as to composition. Obviously, the overhead product from a rectifying column producing Grade 26-70 as a kettle product will be somewhat different in composition when compared with overhead products produced in the course of manufacturing substantially butane-free natural gasoline. Since this overhead product constitutes the raw material for the commercial products, propane and butane, some variation in the nature of at least one of these products is to be expected. The variations, although rather great, are not as serious as one might be led to expect, since the more important physical properties of all of the major components of these products are very similar. A study has been made of the compositions of these various mixtures with the conclusion that the differences in the resulting properties are of no material consequence.

Basis of Specifications

In approaching our problem of establishing proper limits for the commercial liquefied petroleum gas products, a number of factors and influences encountered in the utilization of the products which might serve to place limitations on the properties were studied. It was recognized that such influences and factors when properly coupled with the various manufacturing and transportation problems would constitute a logical starting point in the consideration of rational specifications.

Commercial Propane

Thus in the case of propane, the following factors were deemed worthy of consideration:

(1). The range in composition which can be tolerated in connection with the proper combustion of the product in a propane appliance.

(2). The results obtained in the simple distillation of blends of propane and butane or, in other words, the vaporization characteristics.

(3). The fact that specifications should, if possible, include the competitive propane-propylene products which will undoubtedly continue to be manufactured from refinery vapors.

(4). The transportation vapor pressure limit of 105-A-300 tank cars and the relationship it bears to the highest ethane content product which can be handled in such cars.

(5). The average properties of commercial propane now being marketed.

(6). The fact that the specifications should, if possible, be based on simple tests if such tests will serve properly to define the product. It has been observed in connection with this last factor that the close interrelationship of the properties of light fractions makes it possible to limit the composition, heating values, and all of the other important characteristics by placing limits on the vapor pressure and the end points of the product.

Some of these factors it will be noted tend to establish limits for the product while others afford simple means of defining the limits. For the purpose of added clarity, each of these factors will be briefly analyzed.

Composition and Vaporization Characteristics: Rather definite proof has been obtained in a number of investigations which indicates that a maximum of 5 per cent by liquid volume of butane can be present in bottled gas with no bad effects. This is true both from the standpoint of combustion of the product in conventional propane appliances and also from the standpoint of freedom from vaporization difficulties at low temperatures. Similarly, products containing several per cent ethane can also be tolerated. It is, therefore, apparent that a standard of purity of 95 per cent propane would take care of all problems concerning either combustion or vaporization.

Vapor Pressure: All of the remaining factors considered can best be approached from the angle of permissible vapor pressures. Thus, it may be noted that in the case of the 105-A-300 tank car, the allowable upper vapor pressure limit is 225 pounds gauge pressure at 105° F. This means that a propane product containing 5 per cent ethane can readily be accommodated or, in other words, the product representing the extreme of what can be utilized satisfactorily in a propane appliance can readily be transported in a 105-A-300 tank car. A further study along this line indicates that any product within the vapor pressure limits of the 105-A-300 car can readily be transported in the conventional propane cylinders. These observations automatically eliminate the necessity of any further consideration of shipping containers.

In order to provide for the competitive propane-propylene refinery fractions which we have felt is necessary, the properties of such products will also have to be considered. The vapor pressure of pure propylene is such that this product can not be transported in the 105-A-300 car. This fact, however, will not rule out the shipping of refinery products because the average refinery gas shows a propane-propylene ratio high enough to bring the resultant vapor pressure of the commercial product within the 105-A-300 limit.

In summary, after all these factors were considered, it was concluded that the adoption of the upper transportation limit of the 105-A-300 tank car for the upper vapor pressure limit of commercial propane would be a logical step toward specifications.

Sulphur Content: Although the sulphur content of the commercial propane made in the natural gasoline industry is normally low enough to be of little consequence, a specification was considered necessary to cover this point in order to eliminate possible corrosion difficulties. Inasmuch as some manufacturers are employing non-corrosive sulphur compounds to impart an odor to the propane vapors, any limit placed on sulphur should obviously be made high enough so that it will in no wise restrict the use of such compounds.

In attempting to arrive at a satisfactory sulphur limit, the average values as observed for manufactured gas were considered as a known satisfactory upper limit after converting to an equivalent thermal basis. The limit thus arrived at when compared with observed values for stenched propane indicated that it would not place any undue restriction on such products. Consequently, it was approved for propane with the additional provision that the sulphur present should be limited to relatively inactive organic sulphur.

Dissolved Water: Through experience, the industry has learned that propane when completely saturated with water causes regulator difficulties in cold weather. The information available to the Specification committee indicated that such troubles could be entirely eliminated if the product were completely or at least partially dehydrated. Inasmuch as a satisfactory test for the determination of the saturation of propane with water was available, a clause was inserted along with the other specifications to provide for partial dehydration of the product

Commercial Butane

The methods employed in the utilization of butane are such as to permit a much

*Portions of a paper entiled "The Properties of Liquefied Petroleum Gases as Affecting Specifications with a Discussion of the Problem of Odorization," presented before the 11th Annual Convention of the Natural Gasoline Association of America, Tulsa, Okla., May 19, 1932.

greater latitude in the specifications than in the case of propane. The drawing up of satisfactory limits for butane is, however, considerably more complex because of the fact that the average product is in all cases a three component mixture and a four component mixture is not impossible by any means. The variations in the properties of such products with changing composition have been studied and such variations have been found negligible as previously stated.

For practical purposes, the factors encountered in the utilization and manufacture of butane which would tend to place limitations on the product are as follows:

(1). The effect of the method of utilization on limiting the inclusion of hydrocarbon materials heavier than butane.

(2). The transportation vapor pressure limit of the 104-A-100 tank car and its relationship to the highest propane content product which can be handled in such cars.

(3). The characteristics of the "butane fraction" made under extreme conditions.

A brief analysis of these various factors will serve to bring out their effects in imposing limitations on butane.

Composition: A study of the methods of utilization indicates that butane when used for either gas enrichment or for direct gas manufacture presents the same problems. In considering the first factor, namely the dew point, it can safely be said that no troubles would be experienced on the diluted gas if even greater percentages of "heavier than butane" material were allowed than is now the case. However, there is an indefinite practical limit to the amount of heavy material which can be included, since dew point difficulties on the undiluted vapors must be avoided. Data have been submitted which indicate that the maximum allowable inclusion of "pentanes and heavier" in butane which can be tolerated if dew point difficulties on the undiluted vapors are to be avoided at 50° F. and 5.0 pounds gauge pressure is approximately 1.3 per cent by liquid volume. It has been concluded that since the heavy material present in commercial butane may be due to either actual inclusion of pentanes in the rectifying process or to contamination in storage by material still less volatile than pentanes, both of these possibilities should be considered in placing the limit. Under the circumstances, the limit has been placed at 2.0 per cent by volume and is expressed in terms of the maximum allowable 95 per cent evaporated temperature for the sake of simplicity.

Vapor Pressure: The vapor pressure limit for butane was arrived at in much the same manner as in the case of propane. The upper vapor pressure limit of the 104-A-100 car was found to be the most logical figure.

Sulphur Content: Inasmuch as butane will find its major outlet through the manufactured gas industry, a definite limitation must be placed on the allowable sulphur. Sulphur, when present, will be due either to its occurrence in the raw material from which it was made or to the intentional addition of sulphur compounds for the purpose of imparting odors. As in the case of propane, the average value for manufactured gas was used as a basis and it was then found that a limit of 20 grains per thousand feet of the diluted vapors would take care of all conditions satisfactorily.

Specifications for Propane and Butane

Based on the analysis just completed, specifications have been prepared for both of these products and the necessary test procedures have also been carefully standard-

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ized. As finally approved the specifications and testing methods are as follows:

For Commercial Propane

I. Definition: Commercial propane shall be construed to mean a hydrocarbon product composed predominantly of propane and/or propylene.

II. Composition: The composition of commercial propane shall be at least 95 per cent propane and/or propylene by liquid volume as determined by the combined results of the Vapor Pressure and Mercury Freezing Tests.

III. Mercury Freezing Test: The residue as determined by means of the Mercury Freezing Test shall not be more than 2 per cent by volume.

IV. Vapor Pressure: The vapor pressure at 105°F. as determined by the Liquefied Petroleum Gas Vapor Pressure Method shall not be in excess of 225 pounds per square inch gauge pressure.

V. Sulphur Content: Corrosive forms of sulphur such as dissolved hydrogen sulphide and mercaptan compounds of a highly reactive nature shall be entirely absent. The concentration of relatively inactive organic sulphur present in the flash vaporized product shall not be in excess of 15 grains per 100 cubic feet of vapor.

VI. Water Content: The water content shall be such that the product will satisfactorily pass the standard cobalt bromide test.

For Commercial Butanes

I. Definition: Commercial butanes shall be construed to mean a hydrocarbon product composed predominantly of butane and/or butylenes.

II. Vapor Pressure: The vapor pressure at 105°F., as determined by the Liquefied Petroleum Gas Vapor Pressure Method, shall not be in excess of 75 pounds per square inch gauge pressure.

III. Final Boiling Point: Not less than 95 per cent of the material shall evaporate below a temperature of 34°F., as determined in the Open Cylinder Weathering Test.

IV. Sulphur Content: Corrosive forms of sulphur, such as dissolved hydrogen sulphide and mercaptan compounds of a highly reactive nature, shall be entirely absent. The concentration of relatively inactive sulphur present in the flash vaporized product shall not be in excess of 20 grains per 1000 cubic feet when expressed on the equivalent thermal basis of 550 B.t.u. enriched or manufactured gas.

V. Water: Shipments shall be entirely free of mechanically entrained water.

United Cities Utilities Takes Over Utilities G. & E. Butane Properties

FORMATION of the United Cities Utilities Co., Chicago, Ill., is announced by Arthur K. Lee, president, and R. C. Douglas, vice-president and general manager. The new company has been formed to take over the butane properties of the Utilities Gas & Electric Co. of Chicago, of which Byron T. Gifford is president. Subsidiaries will be the following: North American Utilities Co., operating in Hastings, Minn., Central Wisconsin Gas Co., operating in Waupaca, Wis.; Southwestern Wisconsin Gas Co., serving in Sparta and Tomah, Wis.; Tennessee Gas Co., serving in Columbia, Marysville, Morristown, Murfreesboro, Shelbyville and Union City, Tenn.; Georgia Gas Co., operating in Gainesville, Ga.; Carolina Central Gas Co., serving Hendersonville, N. C.; South Carolina Gas Co., serving Gaffney, S. C.; Southeastern Illinois Gas Co., operating in Harrisburg and Vandalia, Ill.

Mr. Douglas, formerly general manager of the Interstate Gas Co., has been elected president and active operating head of the subsidiary companies, as well as vice-president of the parent company. Mr. Lee was formerly president of the Argus Gas & Fuel Co. of Dodge City, Kan., which was purchased some time ago by Northern Gas & Pipe Line Co.

Liquefied Petroleum Gas May Be Used for Orchard Heating

The Liquid Gas Orchard Heater Corp. has been formed, headquartered at Pomona, Calif., to market a device for heating citrus orchards with liquefied petroleum gas. If experiments are successful, the appliance will represent an entirely new market for butane gas. Each installation will require a central liquid storage tank of from 3 to 5 thousand gallons capacity, and piping in small sizes for distributing the gas to high pressure burners. Contracts have been taken to install the system in a number of citrus groves in Southern California.

Hutchinson Gas Co. Getting Ready to Begin Service

Hutchinson Gas Co., Hutchinson, Minn., has begun construction of the butane gas distribution system in that city. Construction of the plant is also reported under way, with American Gas Construction Co. of Minneapolis, Minn., doing the work. John Allen of Minneapolis has been named manager of Hutchinson Gas Co., and the franchise granted to American Gas Construction Co. is reported to have been transferred to Hutchinson Gas Co., which will operate the plant and system.

New District Opened For Philgas Distribution

Philgas Co., Detroit, Mich., has opened a new district for distribution of the company's bottled gas. The new district will headquarter at Canaan, Conn., and will include the following towns: Norfolk, Winsted, Lakeville, Salisbury, and Sharon, Conn.; Stockbridge, Housatonic, Great Barrington and Sheffield, Mass., and Pine Plains, Millerton and Amenia, N. Y. George Sawallesh has been named manager of the district and will be assisted by Francis Cook. Mr. Sawallesh was formerly Philgas service representative in its Haskell district.

Liquefied Petroleum Gas Production Gains 6,129 Per Cent

According to the Philgas Co., Detroit, Mich., the liquefied petroleum gas industry has shown a growth of 6,129 per cent since 1926, using 1926 production figures as 100 per cent. In 197 the increase was 235 per cent; in 1928, 972 per cent; in 1929, 2,135 per cent; in 1930, 3,874 per cent and in 1931, 6,129 per cent. The figures released by the company estimate an increase of 9,246 per cent for the year 1932.

To Begin Montevideo Plant July 1

American Gas Construction Co. expected to begin construction of a butane plant and system at Montevideo Minn. about July 1 according to recent report.

Empire Southern Gas Co. Extending Mains and Service Area

An expansion program, consisting of laying 5 miles of new gas mains, has been announced by the Empire Southern Gas Company at Brady, Texas. Work will be started in June and will give employment to at least 50 men over a period of two months.

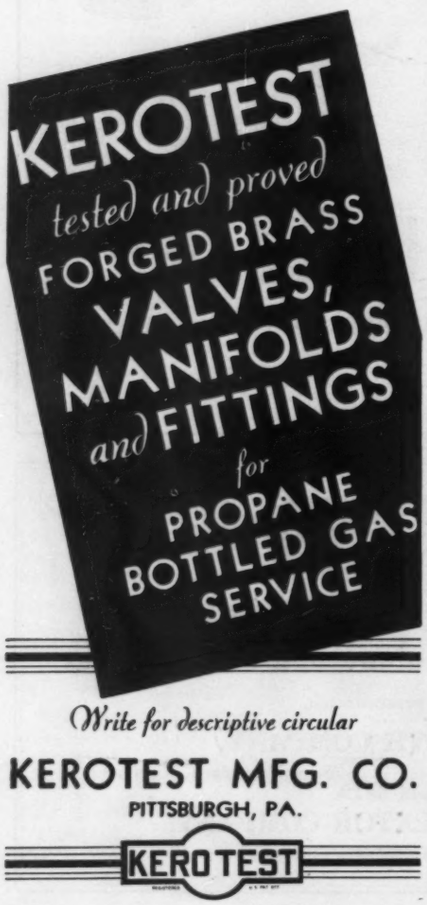
Two miles of new 4-inch mains will be laid in Brady's industrial district, and new 8-inch mains will replace 3 miles of 4-inch distribution line in the residence district.

Iowa Gas Distributing Co. Preparing to Serve Forest City

Construction of a lateral to serve Forest City, Iowa, is nearing completion by Northern Gas and Pipe Line Co., of Omaha, Neb. Route of the line takes it along Highway No. 9. Iowa Gas Distributing Co. will distribute the gas, and has established an office and display rooms in the John A. Olson building. Earl Fields has been named manager and C. E. Wiser will assist him as engineer.

Death of G. E. Howard Announced

G. E. Howard, superintendent of compressor stations for Panhandle Eastern Pipe Line Co., Kansas City, Mo., died recently in Kansas City. Mr. Howard, before becoming affiliated with the Panhandle Eastern organization, was in charge of all compressor plants for Ohio Fuel Supply Co., Columbus, Ohio.



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House Heating Handbook Prepared By New Jersey Gas Association

An engineering field manual for gas house heating salesmen has been prepared by the Industrial and House Heating Committee of the New Jersey Gas Association. In the manual is assembled a wide variety of tables, charts and other data pertaining to every phase of house heating work.

The handbook is designed for field use. The sheets are in loose leaf form, size 3¾ inches by 6¾ inches, and are contained in an attractive and serviceable leather covered binder.

The table of contents indicates the scope of the handbook and its usefulness to house heating engineers: Determination of Heat Loss of Buildings; Steam and Hot Water Heating; Warm Air Heating—Fan Type—Gravity Type; Estimating Gas Consumption; The Automatic Gas Burner; Domestic Water Heating; Industrial and Commercial Building Heating; Data on Other Fuels; Physical Units and Tables and Miscellaneous Information.

Further information may be obtained by writing to H. P. Morehouse, chairman, Industrial and House Heating Committee, New Jersey Gas Association, 80 Park Place, Newark, N. J.

A New Protected Metal Reported by Mellon Institute

According to a recent research report by Dr. A. W. Coffman, a new protected metal called "Robertson-Bonded Metal" (R-B-M) has been carried through the laboratory stages of development at Mellon Institute of Industrial Research. Copies of this report, giving complete information concerning this new material, may be obtained by applying to Mellon Institute, Pittsburgh, Pa.

Robertson-Bonded Metal is the result of extensive research that has led to the production of a laminated metal-felt material in which felted materials are cemented to steel with heat and pressure, utilizing metals as adhesives. The composite laminated material, the outer surfaces of which are suitable felts, is then saturated with any desired saturant chosen with reference to the corrosive condition to which the metal is to be exposed in service.

Andres Appointed Refrigeration Mgr. for Grand Rapids Co.

E. E. Andres, formerly a member of the Detroit City Gas Co., has just been appointed in charge of refrigeration sales by the Grand Rapids Gas Light Co. Mr. Andres has taken over full charge of the refrigeration department, reporting directly to G. Halliday, sales manager.

Mr. Andres has had several years experience in the utility field, with specialized training in refrigeration sales. In addition to his work with the Detroit City Gas Co. he was formerly employed by the Michigan Federated Utilities at Marshall in the new business department.

Financing Operations Going Ahead on Great Northern Gas & Utilities Line

Negotiations are reported to be under way between five leading financial groups in the east and the Great Northern Gas & Utilities Co., headquartered in Minneapolis, Minn. The 24-inch line will cost approximately $22,000,000, and reports state that construction operations will get under way this year, looking toward the serving of the Minneapolis market from eastern Montana gas fields by 1933.

Canadian Gas Ass'n Ready to Convene

AN unusually fine program of papers, reports and addresses is scheduled for the 25th Annual Convention of the Canadian Gas Association, to be held at Winnipeg, Manitoba, June 9 and 10, 1932, according to George W. Allen, secretary-treasurer of the Association.

Geo. W. Allen

Hugh McNair

Hugh McNair, manager, gas utility, Winnipeg Electric Co., Winnipeg, is president of the Association for the 1931-1932 term.

In addition to the program of convention papers, an inspection trip to the by-product coke ovens of the Winnipeg Electric Co. is planned, as well as many entertainment features of merit. An Anniversary Dinner, commemorating the Association's 25th year, will be especially featured, and sight seeing trips are being planned for post session hours.

Among other program features, the following addresses will be given:

"History of Gas Manufacture in Winnipeg", Harry Dunderdale, superintendent of gas production, Winnipeg Electric Co., Winnipeg, Man.

"Methane Gas from Sewage Sludge", by R. O. Wynne-Roberts, consulting engineer, Toronto. Paper to be read by Mr. Archibald Blackie, consulting city chemist, Winnipeg, Man.

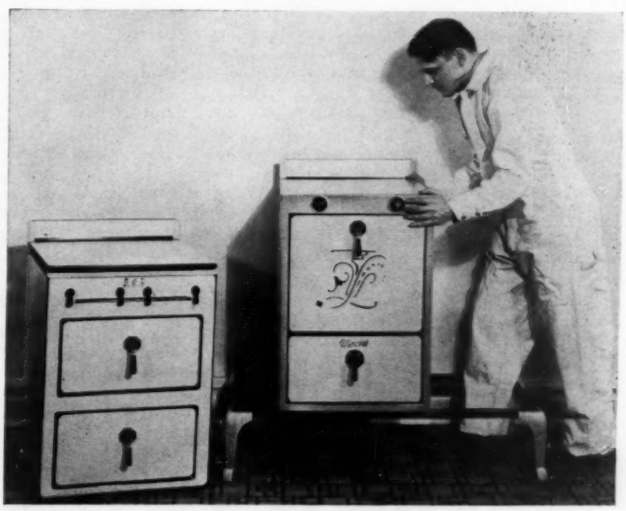
"A New Development in the Waterless Type of Gas Holder", John L. Murray, gas engineer, Cumberland County Power & Light Co., Biddeford, Maine.

"The Use of Gas for the Ignition of Oil and Coal Fuels", Roy Soderlind, combustion engineer, Ottawa Gas Co., Ottawa, Ontario.

"The Unity of Utilization and Rate Making", F. W. Satchwill, acting manager, Winnipeg Electric Co., Winnipeg.

"Gas Leaks, and Supporting Gas Mains Over Cuts", D. O. Wing, assistant superintendent of distribution, Montreal Light, Heat & Power Co., Montreal, Quebec.

THE ILLUSTRATION on the right shows the new reversible range being assembled. Three sections, oven, burner and base, make up the ensemble.



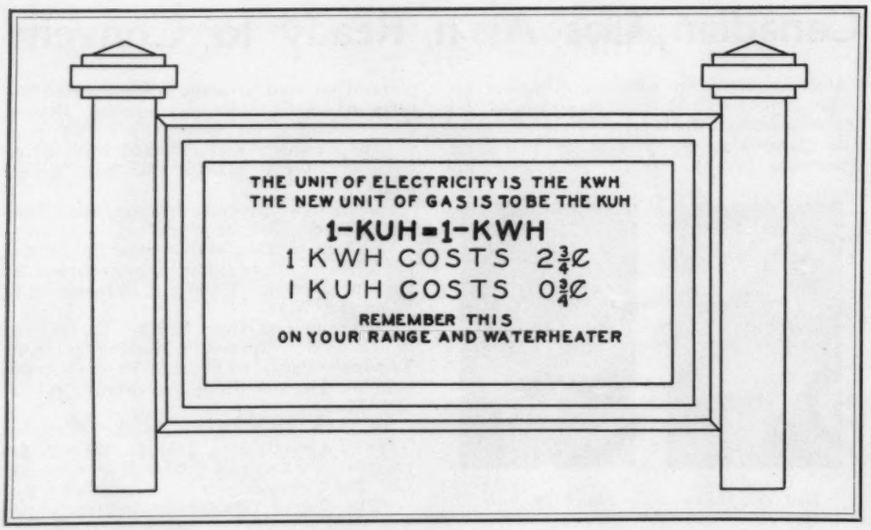
Reversible Range Is New Moore Bros. Product

MOORE Brothers Co. has recently placed on the market a gas range which may be utilized as either a right- or left-hand oven, to be styled Moore's Reversible Buffet. The oven and cooking top may be placed on either side by making the range in three units, the burner section, oven section, and base. The range is manufactured in several styles, is equipped with the company's patented "Hi-Lo" broiler drawer and is finished in either shell ivory or sea green.

H. H. Watson Named Supt. of Construction, Northern States Power

H. W. Fuller, vice-president in charge of engineering and construction, Byllesby Engineering Corp., announces the appointment of H. H. Watson as general superintendent of construction, Northern States Power Co., to be located in Minneapolis. Mr. Watson for the past 10 years has been in charge of the special construction department of San Diego Consolidated Gas and Electric Co.

Announcement also is made that George F. Phythian, who for several years has been in charge of consruction work of the California Oregon Power Co. and Mountain States Power Co., will extend his duties to include the San Diego Consolidated Gas and Electric Co.


THE UNIT OF ELECTRICITY IS THE KWH
THE NEW UNIT OF GAS IS TO BE THE KUH
1-KUH=1-KWH
1 KWH COSTS 2¾¢
1 KUH COSTS 0¾¢
REMEMBER THIS
ON YOUR RANGE AND WATERHEATER

The K. U. H.—Proposed Heat Unit

(Continued from Page 20)

With the above definitions and units as a foundation, the quantitative determination of the energy units to be incorporated into one heat unit can now be decided.

One and only one unit of work is accepted and recognized the world over and that unit is the kilowatt-hour. It would then appear that the most logical, satisfactory and convenient unit of heat would be one that bore a simple and definite relationship to this worldwide standard. Certainly the most definite and convenient relationship that can be established is that of identity and equality.

The kilowatt-hour is a multiple of the joule (1 kwh is 3,600,000 joules) which has gained favor by its size through preventing the numerical values normally encountered from becoming excessive. The prefix "kilo" as used in this sense is a coefficient of 1000, hence, it may be reasoned, the true commercial unit is the watt-hour or 3600 joules.

Now as stated in a preceding paragraph, "any convenient number of energy units that may be selected" can constitute an abstract unit of heat; then to accomplish the transformation from the abstract to the concrete it is but necessary to determine this quantity. As has been stated, the one internationally recognized unit is the watt-hour; therefore it would seem that the most simple, logical, satisfactory and absolute ratio that can be established for a unit of measure in a system of calorimetry is to equate one unit of thermal energy to one unit of mechanical energy, or one unit of heat to one unit of work, or in absolute units one unit of heat is equal to one watt-hour or 3600 joules.

In as much as the kilowatt-hour has proven of greater commercial and practical convenience than the watt-hour, it is safe to assume that the same will be true in the field of heat units and for this reason the commercial and practical unit should be established and standardized at 1000 times the absolute unit and termed the KUH (Kilo-unit of Heat).

This method of reasoning establishes a very simple and effective relationship between the measurement of heat and other forms of energy in that one KUH equals one KWH. Unlimited examples of the simplicity introduced and the calculations eliminated by the adoption of this unit could be cited but they are so obvious that no discussion is required. If a definition of a heat unit in terms of heat would be more favorably accepted than one expressed in terms of energy, it is but necessary to define the unit of heat (UH) as, "the amount of heat evolved by the conversion of 3600 joules (1 watt-hour) into thermal energy". The unit of heat (UH) as defined above is equal to 3.412 B.t.u. and the KUH, one thousand times as great or 3412 B.t.u.

The application of the KUH to established gas schedules is demonstrated on the accompanying conversion chart, which graphically transforms "Dollars per Thousand Feet" into "Mils per KUH" as a function of the heat content of the gas. If reference is now made to this chart and a typical gas rate selected and converted to KUH, it will be noted that relatively more simple figures are involved under average conditions. For example, convert the rate of $1.00 per M, 550 B.t.u. gas to KUH. By following the vertical line indexed $1.00 to its intersection with the sloping line marked 550, the horizontal line at this point of intersection will indicate a KUH rate of 62/100 cents per KUH. Now the average domestic consumption of 550 B.t.u. gas is about 2500 cubic feet per month which at $1.00 per M rate is equivalent to a monthly bill of $2.50. All the above information is imparted in the mere statement that the monthly consumption is 403 KUH at .62c = $2.50. Of equal benefit with the simplicity is the standardization this system introduces, as the 403 KUH noted above would have identical meaning in any locality and be independent of pressure, heat content of the gas and the countless other variable factors that might be involved. Any standard gas meter can be made to read in KUH directly by merely changing the gear ratio and the dials, or the system may be continued of reading cubic feet and converting to KUH from charts or tables.

The psychological effect on the consumer of comparing electric rates in cents against gas rates in mils requires no discussion, and the simplicity of the comparison, in as much as the two units quoted are identical, will enable the housewife and the trained engineer to draw their own conclusions with equal ease.

The relative efficiencies of the varying types of energy consuming devices is a subject entirely foreign to discussion of this nature; however, in order to prevent adverse criticism and unintended misunderstanding over the equality of the KUH and the KWH, it is advisable to state that from 15 to 25 per cent more KUH than KWH will be consumed in delivering a like amount of "useful" heat in similar types of gas and electric appliances.

Doherty Organization Appliance Sales Total $3,299,812 in 1931.

According to Thomas F. Kennedy, manager of the New Business Department of Henry L. Doherty & Co., New York, gas appliance sales of the company for 1931 totaled $3,299,812. Sale of central heating equipment included 2,515 conversion burners, 1,372 gas furnaces and 185 gas fired boilers. Space heating appliances included 6,438 radiant type heaters, 3,321 circulating, 232 radiators, 131 floor furnaces and 19 garage heaters. The annual consumption of these heating appliances will be approximately 800,000,000 cubic feet. Storage water heaters sold totaled 6,801, while 1,300 tank heaters were added to the company's load. Sale of natural gas for domestic and househeating uses averaged 72,700 cubic feet per customer for the year 1931.

Sale of industrial equipment included 545 burners, 81 boilers and 26 furnaces. Commercial sales included 245 hotel ranges, 39 bake ovens, 28 broilers, 74 griddles, 11 steam tables, 25 toasters and 100 urns.

Cast Iron "Zee-Metal" Bolts Announced by Amer. C. I. P. Co.

Completion of a series of tests of cast iron "Zee-Metal" bolts is announced by The American Cast Iron Pipe Co., Birmingham, Ala., manufacturer of the bolt, which is designed for use with the company's "Simplex" products, including Mono-Cast Doublex Simplex Pipe, Monoloy Doublex Simplex Pipe, and Simplex Prepared Joint Pipe.

In these tests, the cast iron "Zee-Metal" bolts developed a tensile strength of 75,000 pounds per square inch, and a minimum "yield point" of 55,000 pounds per square inch, according to company engineers.

Anyone desiring further information may address American Cast Iron Pipe Co., Birmingham, Ala.

Wm. E. Brown, at One Time Manager of Royal City Gas Co., Dies

William Ernest Brown, 75, passed away at the Royal Columbian Hospital, New Westminster, B. C., recently. Mr. Brown was manager of the Royal City Gas Co., New Westminster, prior to the time the company was taken over by the gas department of the B. C. Electric Railway Co., Ltd., Vancouver, B. C. Mr. Brown was a resident of Vancouver and New Westminster for the past 47 years.

Oklahoma Natural Still Serves Gas at Shawnee, Okla.

The Western Service Co.'s gas franchise in Shawnee, Okla., voted in a special election August 6, 1931, has been voided by the Shawnee city commission. The franchise was to have become operative last January, but the company was not ready to begin service. In the meantime, the Oklahoma Natural Gas Corp. has continued to serve the city. Oklahoma Natural's franchise expired in 1925.

New Doherty Co. Building Now Occupied

SIXTY Wall Tower, down-town New York building of Henry L. Doherty & Co. and Cities Service Co. interests recently brought to completion, is shown on this month's cover of *Western Gas*. The building, 67 stories in height, is the tallest building in the down-town area, and the third tallest building in the world.

As the home of Cities Service Company this building becomes the focal point of one of the largest natural gas systems in America. Cities Service Company subsidiaries serve more than 450 towns in seven states—Kansas, Oklahoma, Missouri, Arkansas, Louisiana, Colorado and New York—and Canada, supplying gas to 530,882 customers through 15,416 miles of long-distance transmission and distribution line. This is only one phase of Cities Service activity since subsidiaries also engage in public utility and petroleum industries.

Doherty company offices occupy the first seven floors of the building, with plans calling for the eventual occupancy of the first 16 floors. Henry L. Doherty will have two floors at the top of the tower for his own personal use, one of these floors being given over to a library and study.

Among other features of the building are double-deck elevators, which will serve two floors at a time. An escalator servicing the first six floors is also installed. Two hundred and eleven people will be required to operate the building.

Hazlett to Have Charge of Minneapolis Gas Co. Refrigeration Dept.

Ray C. Hazlett has been appointed manager of the Electrolux department of the Minneapolis Gas Light Co., Minneapolis, Minn., according to announcement made by E. J. Boyer, sales manager for the company. In addition to his new duties Mr. Hazlett will continue as manager of the range department. which post he has held for the past three years.

Mr. Hazlett has been connected with the Minneapolis Gas Light Co. since 1915. His first 10 years were spent in the general offices and he was later promoted to the sales department.

One of his first steps in taking over the refrigeration department was to send out business reply cards on Electrolux which were enclosed with monthly gas bills. The idea worked out well and provided salesmen with a number of prospects for immediate sales. A suitable tie-up was also made with window display and newspaper advertising.

Change-Over to Natural Scheduled for Muscatine, Iowa

Iowa Electric Co., Cedar Rapids, Iowa, plans to change its Muscatine, Iowa, system over to natural gas from water gas in the near future, supply coming from the main line of the Natural Gas Pipe Line Co. of America which passes near the town. Connections with the main line will probably cost in the neighborhood of $75,000.

Papillion, Neb., to be Served

Papillion, Neb., will have natural gas from the Plattsmouth-Omaha line of the Northern Gas and Pipe Line Co., Omaha, through a 4½-mile lateral from the 18-inch line. Rights of way have been secured for the new carrier.

Elmer Temple at Farwell

Elmer Temple has been appointed representative of the Gas Company of New Mexico at Farwell, Tex. Mr. Temple succeeds O. B. Pipkin.

Better Selling Only Basis for Results

By B. H. GARDNER

Director of Sales, Columbia Engineering and Management Corporation

THIS discussion of water heater sales problems in 1932 is fundamental, and could be applied with equal benefit to the sales program for any gas appliance. Mr. Gardner makes it plain that the heyday of easy selling is past—that 1932 results will be had only through adequate preparation of sales plans and careful direction of sales representatives. His discussion from which the following excerpts are taken, was given before the 1932 Mid-West Regional Sales Conference in Chicago.—*Editor.*

THE problems faced in marketing water heaters this year will be very largely the same as the problems faced by those marketing automobiles, radio equipment, or any other goods which fall more or less outside the classification of necessities. The customer buys such goods out of his marginal income, the marginal income being the amount of money he has left after he has paid for the necessities of life. The present outlook is that purchasers will have fewer marginal dollars available this year, and that the competition for these dollars will be keener than in any recent year. The industry that obtains its share of business during 1932, in any given community, will be the industry that has the most compelling advertising, and the best trained sales force; that creates the greatest demand, and follows up that demand most aggressively and effectively.

During 1932, it might be well to do a better job of selling in our own family. Most gas company employees have had steady employment at good wages, and due to the drop in the cost of many necessities, the present wage leaves more for purchases of equipment, such as water heaters. This should be an ideal time for many gas companies to interest their own employees in the purchase of water heating equipment at a low cost and with liberal terms of payment. Those employees buying such equipment would immediately become boosters for the service.

Probably the most important problem in selling water heating in 1932 will be the problem of training the sales organization so that the story of water heating will be placed before the prospect in the proper way, resulting in the creation of the necessary desire on the part of the customer to enjoy hot water service. During 1928, 1929 and even part of 1930, it was comparatively easy to sell goods of all kinds. There was ample purchasing power to satisfy the needs of the mass of the people, with much money left over for luxuries. Little effort was required to sell almost any kind of equipment, and, as a result, many so-called sales departments became little more than "order taking" departments. They did not possess the ability to create desire to the point of forcing favorable action on the part of the customer. So long as money and credits were easy, even a mediocre sales department obtained large volumes of sales. The conditions are very different now, and among the problems of selling water heating in 1932, this problem of a better trained sales force takes first place.

The salesman must be better trained so that he can more effectively present his story, and make his prospect desire a water heater more than he does the hundred and one other things that are competing for his attention and for his somewhat limited purchasing power. Better supervision and training of the salesmen must start with an analysis of just what your present salesmen are now doing, and how effectively they are now working. Generally speaking, most men who have a position today are working at that position energetically and conscientiously. However, this does not mean that they are always working intelligently and effectively. An analysis of the way a salesman plans his work, the effectiveness of his approach, his method of presenting his sales story, and his method of attempting a close, will demonstrate that while many men are energetic and conscientious, they are anything but effective. If a salesman is weak in his approach, his presentation or his close, then that salesman cannot be a consistent or satisfactory producer under present conditions. To bring a sales department to a satisfactory level of efficiency, it is necessary that the work of each man in the department be analyzed on each point, and he must be assisted and strengthened in those points on which he is weak. Only by correcting each salesman on his individual weakness can an efficient sales department be built up and maintained.

One great advantage that will be derived from an analysis of the salesman's work and from sales instruction and assistance, as outlined above, will be an increase in the morale of the sales department. It is undoubtedly true that there has not been a time for many years when the average salesman takes "no" for an answer as easily as today. The experience through which many of them have gone during the past 12 to 18 months has been calculated to develop an inferiority complex. Too many salesmen are starting out in the morning without any very definite idea of closing a sale. Many of them are licked before they leave the office, and they merely go into their territory with the thought of putting in the required number of hours. The negative thoughts in their minds relating to bad times, depressions, and their own lack of results, must be replaced by positive ideas, by the thought that they know their goods, that they know how to present their story and how to proceed with a close. Only by filling the salesman's mind with positive ideas about these lines can successful sales be built during 1932.

A closer and more intelligent supervision of the sales activities must be maintained during this year. Salesmen must not be allowed to waste their time in working in sections where the necessary purchasing power does not exist at this time. Rather their time must be concentrated in sections where the incomes have not been so seriously impaired.

El Paso City Buildings to Be Heated With Natural Gas

A contract with the Texas Cities Gas Co., to heat city buildings with gas instead of coal or oil formerly used has been singed by the El Paso, Tex., city council. R. S. Reading, gas company manager, said the city would save about $500 a year with natural gas, on its present heating bill of approximately $2800.

Asks Franchise at Chrisman

Chrisman, Ill., will probably be added to the list of natural gas towns in the state, as the Illinois Power & Light Corp., has applied for a franchise for that type of service there. The town would come under the supervision of the Danville office of the company.

Missouri Assn. Closes Successful Session

A. E. BETTIS, vice-president of the Kansas City Power and Light Co., was reelected president of the Missouri Association of Public Utilities at its annual convention held April 28, 29 and 30, in Excelsior Springs, Mo.

Mr. Bettis is the first president to be reelected to a second term since the Association was established. Fred Karr, president of the St. Joseph Gas Co., who, as first vice-president, was in line to be elevated to the presidency, made a personal request that Mr. Bettis be retained for another year and complimented Mr. Bettis for his successful handling of the Association's affairs during the past year.

A. E. Bettis

N. R. Beagle, manager of the Missouri Power and Light Co., Jefferson City, Mo., was elected secretary, replacing F. D. Beardslee, of St. Louis. C. E. Michel, vice-president of the Union Electric Light and Power Co., St. Louis, was elected third vice-president, replacing Powell C. Groner, of Kansas City.

Other officers reelected were: First vice-president, Fred Karr, St. Joseph, Mo.; second vice-president, Worth Bates, Missouri Gas and Electric Service Co., Lexington, Mo.; treasurer, Hermann Spoehrer, Union Electric Light and Power Co., St. Louis, Mo.; assistant secretary, Jesse Blythe, Jefferson City, Mo.

The Executive Committe, all retiring members being reelected, is composed of: Maj. T. J. Strickler, Kansas City Gas Co.; Hermann Spoehrer, Union Electric Light and Power Co., St. Louis; W. H. Henby, St. Louis County Water Co., University City, W. H. Swift, Jr., Springfield Gas and Electric Co.; D. W. Snyder, Jr., Missouri Power and Light Co., Kansas City; Abe Vogel, East Missouri Power Co., Louisiana; H. H. Kuhn, Kansas City Power and Light Co.; H. M. Patton, Union Electric Light and Power Co., St. Louis.

Membership in the Association is composed of gas, electric, water and electric railway companies in Missouri. Approximately 200 utility men from throughout the state attended.

R. W. Gallagher, Cleveland, Ohio, president of the American Gas Association, delivered an address at the morning session, April 29. His subject was, "A Message to the Gas Utilities of Missouri."

Philip H. Gadsden, vice-president of the United Gas Improvement Co., Philadelphia, Pa., was scheduled to make an address on "Public Relations in the Utility Field," but was ill and unable to attend. His speech was read at the Saturday morning session, April 30, by W. H. Henby, president of the St. Louis County Water Co., University City, Mo.

W. H. Onken, Jr., vice-president, Security Owners' Association, New York City, made an address April 28 on the subject, "The Utilities' Position Relative to the Present Financial Situation."

Among other speakers and their subjects were: "The Manufacturers' Viewpoint of the Kansas and Oklahoma Anti-Merchandising Laws," George A. Hughes, president, Edison General Electric Appliance Co., Chicago, Ill.

The closing session April 30 was devoted to merchandising. The report of F. M. Rosenkrans, of Kansas City, Mo., chairman of the Association's Merchandising Committee, gave a general picture of the merchandising situation in Missouri and the widespread cooperation between the utilities and local merchants and dealers throughout the state.

John Redmond, Burlington, Kansas, Editor of the Burlington Republican, former president of the Kansas Press Association, made an address on "The Effect of the Merchandising Law in Kansas." He presented facts and figures showing that the anti-merchandising law is a detriment to the people in Kansas, especially in the smaller towns. He said that the editors of newspapers in Kansas are virtually unanimous in urging the repeal of the law by the next Kansas legislature.

A safety exhibition by 22 young ladies under the direction of Albert Rall and Dr. Frank Iuen of the Safety Department of the Kansas City Power and Light Co., Kansas City, Mo., was one of the interesting features of the convention.

The place and date for holding next year's convention will be selected by the Executive Committee at its next meeting.

Consumer Survey by American Gas Assn.

A "CONSUMER Survey of the American Gas Industry" containing data on communities supplied with gas, and utility companies rendering gas service has been compiled and issued by the statistical department of the American Gas Association, 420 Lexington Avenue, New York. The book contains 566 pages, and in addition to being a valuable handbook for gas company executives, gas appliance manufacturers and pipe line construction companies, it gives a graphic picture of the results of expansion programs within the gas industry during the past 10 years.

Several tables of interest and value covering the United States as a whole are given: Summary of Gas Customers by States, Gas Customers by States Classified According to Kind of Gas Supplied, Gas Customers per Thousand Population for Each State, Summary of Gas Companies and Gas Customers by States, Number of Communities Supplied with Gas in Each State, Number of Counties in Which Gas is Distributed, Number of Incorporated Communities with Population in Excess of 2,000 Which are Without Gas Service, Classification of Gas Companies According to Type of Gas Distributed.

Following these tables data for individual states are given.

The following information is given for each state: List of gas companies operating, summary of gas consumers by counties, list of incorporated communities with population in excess of 2,000 which are without gas service, list of counties without gas service, and an alphabetical list of all communities supplied with gas, showing for each community the following data: County in which community is located, population, number of customers, heating value and kind of gas supplied, and name of company supplying the gas.

The following facts were developed by the survey:

The number of customers served by the gas industry increased by 40 per cent between January 1, 1921, and January 1, 1931, from 11,452,000 to 16,009,000. Manufactured gas customers increased from 8,837,000 to 10,471,000, a gain of 19 per cent. Natural gas customers increased from 2,615,000 to 5,523,000, a gain of 111 per cent.

Ten years ago natural gas was distributed in 19 states (and insignificant quantities were distributed in 5 additional states). Now natural gas is consumed in 34 states.

In Texas, the gas industry has made remarkable strides in the past few years due to the discovery of prolific natural gas resources and the rapid construction of pipe line networks radiating from these fields. According to a report of the Railroad Commission of Texas there were 247 communities in Texas supplied with gas on January 1, 1928. According to the American Gas Association survey there were 652 communities supplied with gas on January 1, 1931. This indicates that gas service was established in over 400 communities in Texas in the three-year period.

Three years ago only 20 communities in the state of Nebraska were supplied with gas and all were served with manufactured gas. Now there are 115 communities in this state enjoying the benefits of gas service, and of this total 108 are supplied with natural gas.

On January 1, 1931, a total of 7,832 communities in the United States were supplied with gas, of which 3,074 were being served with manufactured gas, 4,650 served with natural gas and 118 served with liquefied petroleum gas distributed through mains.

There are nearly 1,200 gas companies distributing gas to the public in the United States. This figure does not include numerous companies which produce and transport natural gas and wholesale their entire output to distributing companies.

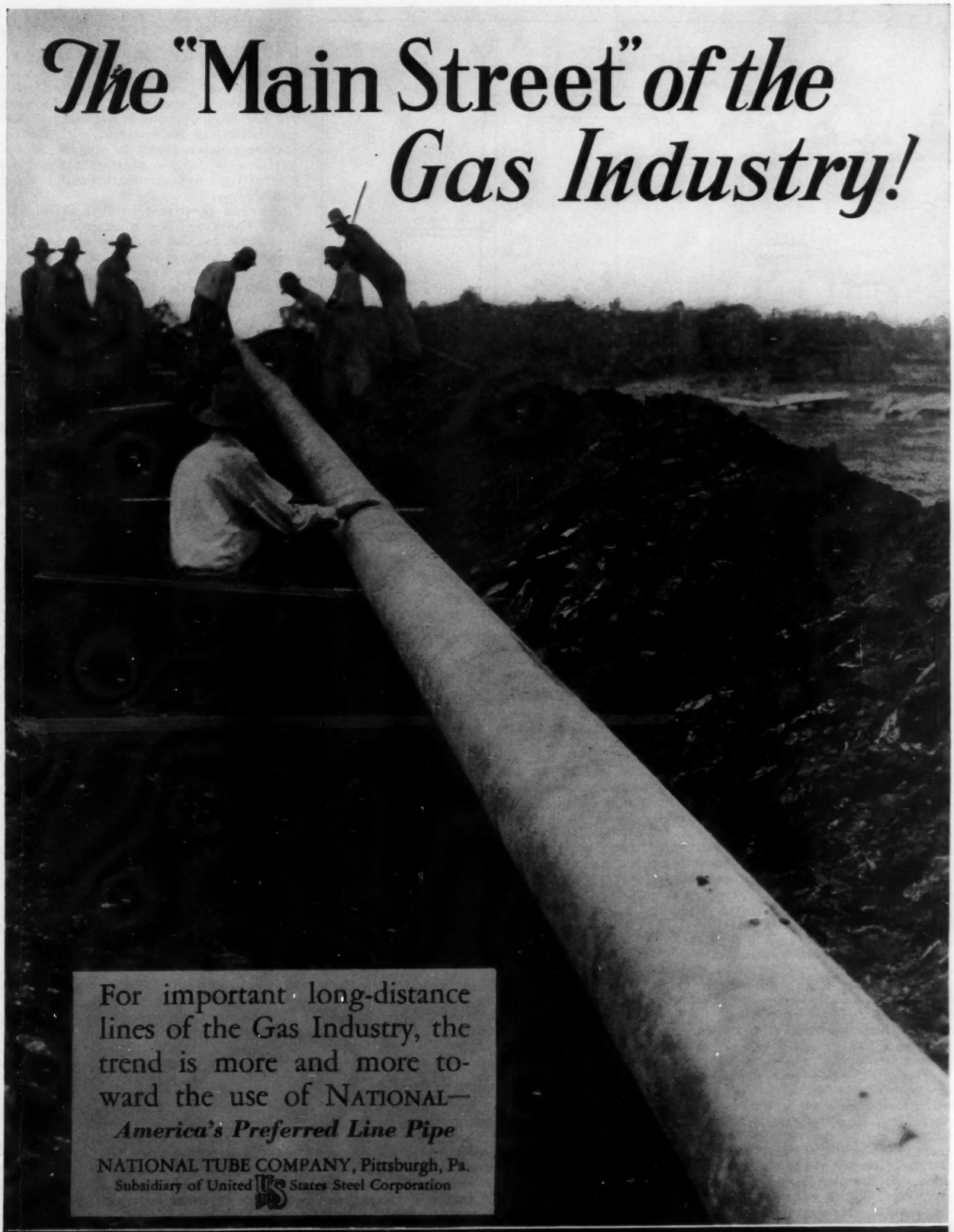
On January 1, 1931, there were 130 gas customers per thousand population of the United States (based on 1930 census). Since gas service is not available throughout the entire country this figure does not give a true indication of saturation in territory actually served. There were 217 gas customers per thousand population of communities actually supplied with gas, or one gas customer for each five persons in such communities.

The state showing the highest saturation on this basis is California (which also ranks first in the number of natural gas consumers), with 289 gas customers per thousand population of communities served. Second in rank is New York with a saturation of 254 per thousand followed closely by Illinois with 253 per thousand. Ohio stands in fourth place and the District of Columbia fifth. Mississippi is lowest in rank with 10 gas customers per thousand population of the entire state and 69 customers per thousand population of communities having gas service.

Rocky Mountain Gas Co. to Serve Natural in Craig, Colo.

Rocky Mountain Gas Co., subsidiary of Ohio Oil Co. will serve gas from the latter company's wells to Craig, Colo., construction of a 3½ mile line being completed in May. Cost of the project is estimated at $80,000.

The "Main Street" of the Gas Industry!



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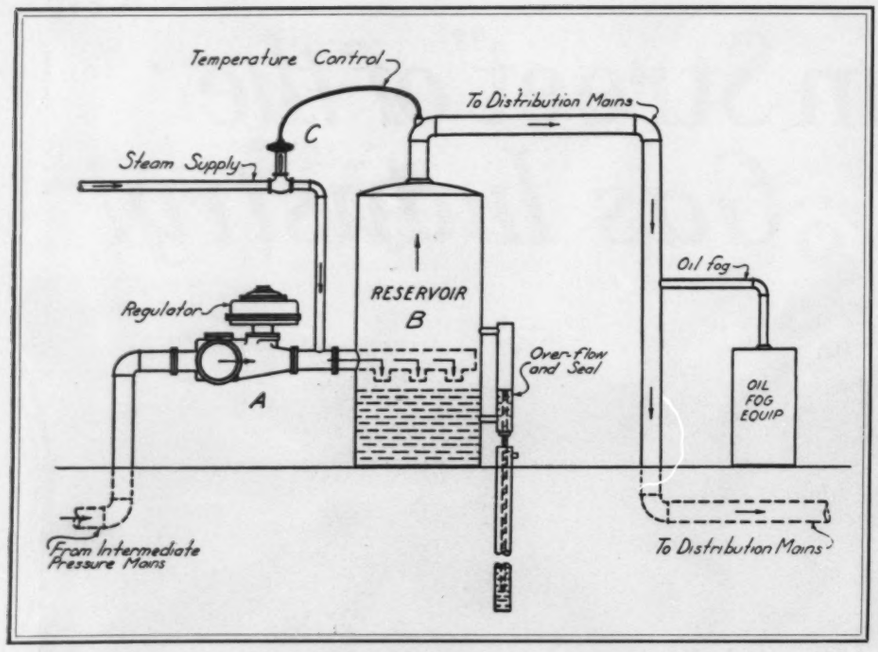

Fig. 5.

Water Vapor in Natural Gas

(Continued from Page 17)

natural gas has upon the pipes, pipe joints, domestic meters, regulators, and miscellaneous equipment constituting the greatest part of the gas distribution company's underground investment, and through which the natural gas is conducted to the customers' appliances.

Generally speaking, gas distribution systems are constructed of cast-iron pipe, steel pipe, or a combination of both. It is usually found that the cast-iron pipe used in the underground gas system was laid years ago, before wrought iron and steel pipe came into general use, and before the rubber gasket type of joint was used in laying cast-iron pipe.

By far the most common joint used in laying cast-iron gas mains was the old bell and spigot type of joint, constructed of lead and jute. In laying steel mains, the screw collar, the patent plain end coupler with rubber gaskets, and the welded joint are the most common methods of joining.

Chemists have proved that to avoid corrosion in steel lines when oxygen is present, the gas must be kept above the dew point, or, conversely, the dew point kept below the temperature of the gas.

While cast-iron pipe, due to the nature of its material, is immune from moisture troubles as far as the corrosion side of the question is concerned, the lead and jute joint is extremely susceptible to the physical characteristics of the gas carried. This is especially true, and the effect is quite evident, if the cast-iron mains in question at one time carried manufactured gas, only to have it supplanted by natural gas.

Manufactured gas is not only water saturated, but carries many compounds such as tar oils and naphthalene, and others more or less easily condensed.

In the process of carrying manufactured gas, the joint material becomes saturated first with water, then with naphthalene and various condensates. It has been demonstrated that the lead in the joint plays a very small part in making the joint gas-tight, but does provide a substantial support for the jute. The jute swells and makes and maintains an ideal joint; viz., a gas-tight joint. In the case of steel pipe, the interior of the pipe becomes coated, obviating any corrosion, and the joints are cemented or gummed over with the tar and naphthalene. Under these conditions, a distribution system of steel pipe, cast-iron pipe, or a combination of the two, would be fairly tight *and moist.* The same may be said in regard to the meter diaphragms and regulator diaphragms which, through contact with a saturated gas, will have absorbed quantities of water, tar, oil, and other condensates carried by the manufactured gas.

In the event natural gas in introduced into such a distribution system, supplanting the manufactured gas, as has been done recently in many cities in the South, Middle West, and West, a condition is set up which, if allowed to continue, may involve a great expense, first, in gas lost, and second, in remedial measures that must be taken to correct the leakage set-up.

The condition referred to is the drying-out effect caused by the but-partially-saturated natural gas. Although at the point of delivery, near the city border, the gas may be saturated in the low-pressure distribution mains where it is customary to carry but 6 to 10 inches of water pressure the degree of humidity will be considerably decreased, due to the change in pressure.

Denver's Experience

The distribution plant at Denver, Colorado, up until August, 1928, had carried for nearly a half-century saturated manufactured gas, and it was anticipated that joint trouble would arise upon the introduction of natural gas. A definite procedure was, therefore, determined upon to prevent the trouble if possible.

Samples of jute were removed from the cast iron bell and spigot joints in various locations on Denver's distribution system. These samples, enclosed in air-tight containers and properly labeled were sent to a central laboratory for analysis, with the result that they were found to contain 18 to 28 per cent, by weight, of water; about 6 per cent of light hydrocarbons; and 0.2 per cent naphthalene.

Previous experience in Fort Collins, Colorado, Cheyenne, Wyoming, and Shreveport, Louisiana, coupled with the results of these Denver laboratory tests, indicated the importance of sending only saturated gas through Denver's distribution system. Experience at Cheyenne also had shown that once a system is allowed to dry out and is leaking badly, the original condition of the joints cannot be restored. Therefore, a program was determined upon to treat Denver's natural gas supply in such manner that the condition of the joints would remain unchanged.

This meant that the physical characteristics of the new gas should be made to resemble as nearly as possible the physical characteristics of the old gas. The physical condition of the joint materials was in equilibirum with the manufactured gas, and it was most essential that this state of equilibrium remain undisturbed.

It therefore was decided to water-saturate the natural gas at low pressure and to inject a light hydrocarbon oil into the gas stream, the latter to simulate as nearly as possible the light tar oils in the manufactured gas and in the pipe joints.

To duplicate exactly the physical characteristics of these tar oils was known to be practically impossible. On the other hand, Dalton's Law indicated that if they were not exactly duplicated, they would in time leave the joint. A light gas oil was chosen, not with a great deal of confidence that it would prevent the evaporation of the light hydrocarbons in the joints, but it was hoped that it would itself be absorbed and in a way replace the naturally deposited condensates. It was known, however, that the injection of oil would tend to cement the scale and rust to the pipe walls.

Inasmuch as Denver's natural gas supply contains no oxygen, there was no possibility of setting up a corrosive condition by the introduction of water.

It goes without saying that in order that no water be evaporated from the pipe joints, the gas must approach 100 per cent humidity. This means it should be water saturated at the temperature of the main.

Since the pressure at the point of saturation is somewhat higher than the average main pressure, being in most cases near the center of distribution, it is usually advisable to warm the gas and saturate it at slightly above main temperature. As the pressure decreases at a distance from the point of regulation, the temperature drop will compensate the drop in pressure and the degree of humidity will be maintained.

There are several ways by which the gas may be water saturated. However, in any case heat must be added in one form or another in an amount, first, to evaporate the quantity of water by which the gas is deficient, and, second, to raise the temperature of the gas to, or slightly in excess of, that of the underground mains. Should the gas be sent out saturated at a temperature lower than that of the gas mains in the process of warming up to ground temperature the per cent humidity will decrease and the effect of saturation will be less. The amount of heat required is developed by a simple calculation an example of which follows:

Assume that the gas is delivered at the

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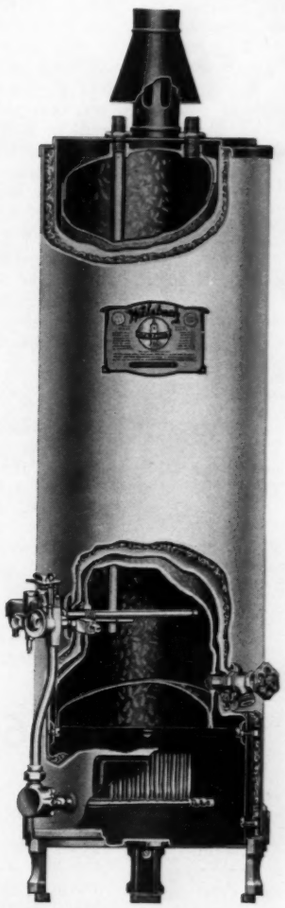

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district regulator station at 60° F., 25-lb. gauge, 50 per cent humidity, and that the main pressure is 8 oz., with a ground temperature of 60° F.

Radiation and other heat losses prevent the gas expanding through the regulator adiabatically and the temperature on the downstream side, therefore, cannot be computed with any degree of certainty. However, experience has indicated that this drop in temperature rarely, if ever, reaches 15° F. Under normal conditions, observations have shown a drop of but 5° F. when the gas is expanded from 25-lb. gauge down to 8 oz.

Assume a barometric pressure of 14.4 lb., at which the per cent humidity, h_2 of the gas on the outlet of the regulator will be

$$h_2 = 50 \frac{0.5 + 14.4}{25 + 14.4} \times \frac{0.5214}{0.4356} = 22.8\%$$

in which

0.5214 = Vap. pres. in inches merc. at 60° F.
0.4356 = Vap. pres. at 55° F.

The foregoing formula is developed as follows:

$$\frac{h_1 V_1 S_1}{T_1} = \frac{h_2 V_2 S_2}{T_2}$$

$$\text{and } \frac{h_1}{h_2} = \frac{V_2 S_2}{V_1 S_1} \frac{T_1}{T_2}$$

where

h is relative humidity
V is volume of water vapor
S is vapor pressure of water in inches of mercury.

But

$$\frac{V_2}{V_1} = \frac{P_1 T_2}{P_2 T_1}$$

Where P and T are absolute pressures and temperatures,

Substituting the value of $\frac{V_2}{V_1}$

$$\frac{h_1}{h_2} = \frac{P_1}{P_2} \times \frac{S_2}{S_1}, \text{ and } h_2 = \frac{h_1 P_2 S_1}{P_1 S_2}$$

Knowing the humidity of the gas under any one condition, it can be calculated for any other condition by means of the above formula, provided, of course, no water is precipitated or added.

At 100 per cent humidity, 64° F. and 14.4 lb., plus 0.5 absolute pressure, the gas will contain 0.943 lb. of water vapor per thousand cubic feet; and at 55° F., 0.699 lb. In the above case, it accordingly will be necessary to evaporate 0.943—(.226 × .699) or 0.785 lb. of water per thousand cubic feet of gas representing the difference between the water the gas already carries and the water it will carry when saturated. Since it is assumed that a 5° drop in temperature takes place in the regulator and that the temperature of the gas leaving the saturating equipment is to be maintained at 4° above main temperature, the temperature of the gas must accordingly be raised 9°. Therefore, the theoretical amount of heat required per thousand cubic feet will be

$$0.785 \times 1055.1 + (1000 \times 0.02627 \times 9) = 1064.7 \text{ B.t.u.}$$

the specific heat of this natural gas being about 0.02627 B.t.u. per cubic foot, at 14.9 lb.

Supplying this amount of heat, both to warm the gas and evaporate the water, may be accomplished in one of several ways. For instance, by the injection of a sufficient amount of steam; by contacting or scrubbing the gas with warm water; or by a combination of these methods. In any event, the heat requirements will be identical.

Suppose, in the case cited above, that a supply of saturated steam is available at 50 lb. gauge pressure. Upon injection into the gas stream, the steam will be first superheated through expansion; then, upon giving up its heat to the gas, it will condense, then evaporate. However, it does not necessarily all condense.

The total heat in steam at 50 lb. gauge, or 64.4 lb. absolute, is 1178.33 B.t.u. At 64° F. (its final condition), the partial pressure exerted by the steam or water vapor will be 0.2949 lb. absolute, and its total heat content will be 1087.6 B.t.u. per pound.

The amount of steam at 64.4 lb. absolute pressure necessary to accomplish the saturation and heating in this case is determined as follows:

1178.3 — 1087.6 = 90.7 B.t.u. per pound given up by the steam, which does not condense.

Since 0.785 lb. of water is required per thousand cubic feet, the heat input to supply this amount of water will be

$$0.785 \times 90.7 = 71.2 \text{ B.t.u.}$$

But 1000 × .02627 × 9 = 236.4 B.t.u. which must be supplied per thousand cubic feet to raise the temperature of the gas from 55° F. to 64° F. Therefore, an additional amount of steam must be supplied which will condense, since the gas already will be saturated. This additional steam, which condenses, will be equal in quantity to the steam required to supply the amount of heat by which the steam required for saturation is deficient.

236.4 — 71.2 = 165.2 B.t.u. the heat deficiency.

1178.33 — 32.07 = 1146.26 B.t.u., the heat of 64.4 lbs. abs. steam above 64° F.

Therefore

$$\frac{165.2}{1146 - 26} = 0.144 \text{ lb., steam required.}$$

It follows, then, that the total steam requirements for saturating a thousand cubic feet of this gas are

$$0.785 + 0.144 = 0.929 \text{ lb.}$$

Design of Saturation Equipment

As to the design of practical installations, provision must be made to prevent the gas stream carrying any considerable amount of suspended water into the gas distribution system. This is accomplished by slowing down the gas stream to such velocity that the suspended water will settle out. A large vertical reservoir, the size of which depends on the amount of gas handled, offers a simple means to this end. Such apparatus is shown in Fig. 5.

Referring to Fig. 5, the gas, after having its pressure reduced to distribution pressure in regulator A, receives at the outlet of the regulator a supply of steam which is controlled by thermostatic valve C. The thermostatic valve is set to maintain some predetermined temperature at the outlet of the apparatus, usually 3° to 5° in excess of the ground temperature. After receiving its supply of steam, the gas enters reservoir B where the excess moisture settles out;—thence it passes into the distribution system.

The above method of saturation is in successful operation in Colorado, where it was first introduced. The degree of its success may be best attested to by those attending the distribution conferences, where it is not unusual to have Denver's leakage record cited as "miraculous."

1760 Range Sales in 9-Day Campaign

(Continued from Page 14)

present market. The results attained during the nine days, however, proved that quality ranges could be sold, and at a profit, even when allowing an abnormally high trade-in. At least one Los Angeles furnishing house has already changed its sales policy as a result, and is now featuring much higher priced models, while the association of which it is a member has set $49.50 as the minimum price at which any range will be advertised.

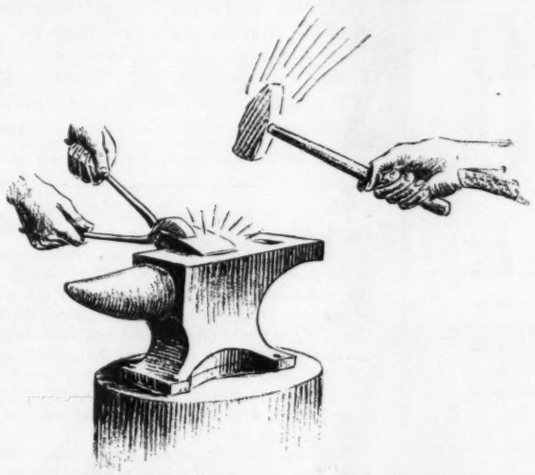
Billboard copy carried by gas companies cooperatively during Southern California range campaign.

Important as was the sale of a large number of ranges at a fairly high price, the most valuable result of the promotion was undoubtedly the demonstration that there is a profit in the sale of high class ranges at a fair price and that cooperation can develop range business when individual effort cannot. Both the sale of quality merchandise at sound prices and the combining of all interested factors in cooperation are steadying influences in any market, and are particularly needed at present in the gas range field, where poor products and ruinous prices have had a most demoralizing effect.

Change-Over at Columbus, Neb., Completed; Lateral to Schuyler

Natural gas replaced water gas in the mains of the Central West Public Service Co. at Columbus, Neb., about May 1, supply coming from the recently completed line constructed north from David City by Northern Gas and Pipe Line Co.

An extension from the new line will serve Schuyler, Neb., where Peoples Natural Gas Co., subsidiary of Northern Gas and Pipe Line, has opened an office and display room. H. E. Wedge of Wells, Minn., has been named manager at Schuyler, assisted by R. A. Donovan.



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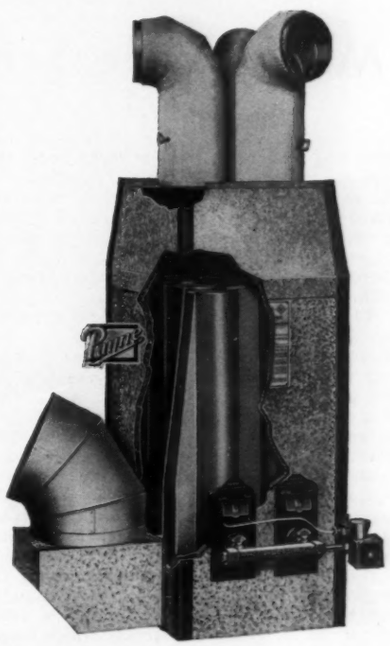
for a BIG Heating Load Next Winter

THE efforts you make in the early summer while the memory of last winter's discomforts are fresh in the minds of thousands will decide your rewards for next winter and the years to come.



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They are CONTROLLED

Even temperatures, at just the point for maximum comfort, automatically regulated without labor or attention. Every day as enjoyable as a lovely June morning.

They are HEALTHFUL

Pure, circulated warm air without drafts in every nook and corner of the house. No burned gas, no stagnant air. No drowsiness or listlessness.

New Models at New Low Prices

Greater heating capacity at the same high efficiency. Other improvements.

Heaters built by Payne will *not* "sweat" walls and windows, tarnish silver or hardware or cause mildew in draperies and hangings.

VENTED Payne Gas Furnaces make friends of consumers and draw them closely in the bonds of satisfaction and appreciation.

Let's get together on

A Summer Campaign for Winter Heating

We have a plan for cooperation we'd like to explain.

PAYNE FURNACE & SUPPLY COMPANY, Inc.

BEVERLY HILLS, CALIFORNIA

"There is a PAYNE HEAT *System for Every Climate and Building"*

COMPLIES WITH NATIONAL SAFETY REQUIREMENTS · AMERICAN GAS ASSOCIATION · APPROVED

Payne Furnaces are submitted to the A. G. A. Testing Laboratory—approval signified by above seal.

Form 191—2M—4-31

PORTLAND GAS & COKE COMPANY

APPLIANCE MAINTENANCE ACKNOWLEDGEMENT

CREDIT ACCOUNT
Misc. Appliances 66A
Water Heating 66B
House Heating 66C

NAME..... No.....
PRINT
ADDRESS..... City.....

The undersigned hereby acknowledges performance of work and receipt of material at the above address, as specified below:

Nature of service.....

.....

Labor..... $.....

Material.....

..... $.....

for which he agrees to pay the sum of..... $.....

Date of service rendered..... Signed.....
CUSTOMER

Work done by..... Address.....

Maintenance Service for Appliances

(Continued from Page 27)

tools and equipment thought to be necessary and an operator chosen from the ranks of the service men. Our service men were then asked to and did gain the permission of a given number of our customers thought to be in need of such service, permitting us to thoroughly clean and adjust the gas appliances in use.

This maintenance man was accompanied by an engineer who made detailed time studies of all the major operations, including traveling time as well as the time on the premises. The actual work of cleaning was divided into several subdivisions thought to encompass the more important functions pertaining to the work. This engineer also made observations concerning the tools and equipment necessary or advisable, and at the same time observed the manner and approach of the maintenance man as well as the attitude of the customer prior to and following the completion of the work. In total, the engineer's mission was to submit a rounded out report that would reflect rather a vivid picture of the entire transaction, which would give us an opportunity to estimate the value of the undertaking.

It was thought that the endeavor would be manifold in its benefits, working on the theory that clean and properly-adjusted appliances would permit the customer to reap the most satisfactory benefits from the service we purport to render; that complaints would be eliminated; that more use would be made of the appliances in good working order; that the maintenance man could exercise a keen intuition concerning the replacement or possible addition of appliances.

The time studies showed that the work could be done satisfactorily on the customer's premises within a fairly reasonable length of time, and that once the work was standardized, could be done at a cost which would be attractive to the customer.

It was found that most of the customers in need of the service used only a range, or a range and water heater. A few had additional appliances such as a radiant type heater, refrigerator, washer or ironer, but the first two classifications constituted the majority. Therefore, a flat price of $2.25 was established for which all gas appliances on the consumer's premises with the exception of major house heating would be thoroughly renovated and made to operate as satisfactorily as the age and condition of the appliances would permit. This service includes cleaning all burners, grates, linings, exteriors and vents; re-enameling where necessary; bronzing oven and broiler linings; and properly adjusting all burners and controls. An extra charge is made for the material only in the replacement of parts.

The cost of outfitting the truck with the tools found necessary for efficient work was about $300. A list of the tools is given in Table No. 1.

A summary of the work performed to date by this truck shows 301 orders completed, totaling 43 appliances cleaned and serviced. These include 134 orders wherein a range was the only gas appliance in use, and 157 installations which included a range and a water heater. The remaining 10 orders included from one to three additional gas appliances.

The average time required to complete this work, as recapped from the time study sheets, will probably be of interest to those contemplating the introduction of such service within their own company. The work of reconditioning a range was divided into 12 parts, and the time recorded for each division as follows:

Reconditioning Ranges—Average of 301 Jobs

	Minutes
1. Preparation, arranging tools from truck, etc.	11.8
2. Cleaning top of ranges, solid top or grates	11.7
3. Cleaning top burners and pilot	21.2
4. Cleaning areation plate, drip pans, etc.	7.3
5. Cleaning oven and broiler burners	19.2
6. Cleaning oven, buffing linings, etc	17.
7. Checking and adjusting heat control	1.1
8. Checking gas rate, pressure, etc...	.6
9. Cleaning exterior of range, sides, front, and back	23.2
10. Enameling, painting and bronzing	15.3
11. Replacing broken parts	3.3
12. Clean up, and replacing tools in truck	13.3
Total time for reconditioning ranges	151.0
Work of cleaning other appliances on job	14.
Travel time between jobs	38.
Total	203 Minutes, or 3.39 hrs.

(Note: Units for such operations as checking oven controls, gas rates and pressure are low for the reason that the work is not performed on all jobs.)

It will be seen from this study that about 3½ hours are required to thoroughly recondition appliances on the job, including the traveling time. The cost of the work, with the exception of a few supplies in the nature of paint, sandpaper, etc. is labor and truck time. Very little office overhead is chargeable to the work as a copy of the order signed by the customer is left as an invoice, and the charge is posted directly to the merchandise ledger account and entered on the current month's gas bill.

But for the economic uncertainty of the past few months during which this maintenance service has been given, we would undoubtedly have had considerably more work of that nature, and would have been able to reduce the average time somewhat, particularly that for traveling time, as more efficient routing could be obtained. However, as the work was in more or less an experimental stage, more consideration was given to the rendering of prompt service than to efficient routing.

It would be putting it mildly to say that the customers were satisfied with the service. A good many were enthusiastic, and induced friends or neighbors to take advantage of the offer. We found that the average housewife, through carelessness or lack of proper knowledge, who did not keep her gas appliances clean, was encouraged to spend the necessary time each day, after watching the maintenance man at work and listening to his diplomatic suggestions.

Many benefits, both tangible and intangible from a company standpoint, more than offset the small loss occasioned by the low price obtained for the service. Aside from the good will and the customer satisfaction, the reconditioned appliances are being used more extensively and the number of possible mechanical complaints have been reduced. Also, sales of additional or replacement appliances have been made as a result of the timely suggestions of the maintenance man.

In all, we have found the venture to be an entirely satisfactory one from a company standpoint as well as from the customer's point of view. Now that our time study and experimental work is practically complete, we propose to give the subject the publicity to which it is entitled, and ultimately readjust the cost to the consumer to cover our bare expense incidental to the traffic.

Table No. 1. List of Special Tools and Equipment for Appliance Maintenance Service Truck

Portable electric air compressor outfit of one cubic foot capacity. For spraying paint and blowing out burners, housepiping, etc.

Portable electric drill, 5/16 chuck, equipped with small grinding wheel, wire brush, and buffing wheel attachments. For reaming ports and polishing work.

Portable hand vacuum sweeper, with extra length of hose, blower and suction attachments. For cleaning ranges and kitchens.

Portable paint spray gun and cup attach-

COOKING FUEL COSTS CUT $400.00 A MONTH BY HOTEL SHERMAN, CHICAGO

Here's a story that will help you turn prospects into purchasers. Use it.

EARLY in 1930 the Hotel Sherman Company, Chicago, decided to save money by replacing obsolete cooking equipment. New Vulcan, All-Hot-Top and Open Top Insulated, Heat Controlled Gas Ranges, Vulcan Deep Fat Fryers, Radiant and Salamander Broilers were installed.

Mr. Albert H. Byfield, Vice-President, wrote recently: "The last seven months of 1930 cost us $7,003.00 in gas. The corresponding seven months of 1931, during which time we used the new ranges, showed a corresponding cost of only $4,017.00. January, 1932, shows a saving of approximately $400.00 as compared to the average of the preceding four years, and February is nearly as good."

The new equipment paid for itself in eight months out of the $400.00 a month savings in fuel . . . and now the $400.00 monthly saving is clear gain.

Everyone may not be able to show as large a saving, because the operating cost is based on amount of equipment, cooking done, age of equipment, and fuel. But, we do say that it will be to your advantage to call on hotels, restaurants, clubs, hospitals and schools, look over their equipment, get cost of operation and show them how new Vulcan equipment will help them cut their cooking costs.

5 WAYS THE NEW VULCAN GAS EQUIPMENT CUTS COOKING COSTS

1 Heat losses and gas consumption in oven cooking reduced by heavily insulated oven walls.

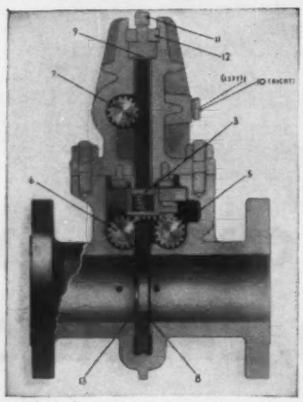
2 Over-heated ovens and resultant food shrinkage and waste of gas prevented by oven heat control.

3 Oven heat used more effectively in baking and roasting by improved flue system.

4 Top cooking made more efficient by All-Hot-Top. Heat of one burner spreads under entire top. All rings of burner quickly heat the top. Then one ring keeps it hot economically.

5 Labor costs reduced because range requires less watching due to automatic control . . . smooth front of range is kept clean with less work. More comfortable working conditions increase the efficiency of help.

STANDARD GAS EQUIPMENT CORPORATION
20 EAST 41st STREET, NEW YORK CITY
New York . Philadelphia Baltimore . Chicago . Boston . Birmingham
Pacific Coast Distributor . . . Northwest Gas & Electric Equipment Co. . . . Portland, Oregon



Change ORIFICE PLATE in 2 minutes

The Daniel Orifice Fitting is an outstanding improvement. Every operation is clean-cut and positive. Time is saved, as well as trouble. By means of a simple crank movement the orifice plate within its carrier can be lifted to the top chamber without danger to the operator or fear of leakage. Then the top chamber can be completely isolated from the line, vented and quickly opened to atmosphere, and the orifice plate lifted out and replaced. The various operations, for complete change or inspection of plate, require from 1½ to 3 minutes—usually less than 2 minutes.

PARTS

1. Equalizer valve. 3. Slide valve. 5. Valve actuating shaft. 6. Lifting shaft. 7. Lifting gear. 8. Carrier. 9. Sealing bar with gasket beneath. 10. Bleeder valve. 11. Set screw. 12. Clamping bar. 13. Orifice plate.

Safest—Simplest
Easiest to Operate
Most Compact

DANIEL ORIFICE FITTING

Equally efficient on gas, steam or air lines

Ask for literature.

J. A. CAMPBELL

Manufacturer and Distributor
P. O. Box 669
Long Beach California

ments. For enameling and bronzing appliances and parts.

Small Tools

1 94F Imperial tube cutter.
1 93F Imperial flaring tool.
1 No. 20 set Bonney end wrenches.
1 A14-4″ Crescent end wrench.
1 AC 16-6″ Crestoloy end wrench.
1 AC 19-8″ Crestoloy end wrench.
1 AC 110-10″ Crestoloy end wrench.
1 8″ Stillson wrench.
1 10″ Stillson wrench.
1 14″ Stillson wrench.
1 0370 6-oz. plomb, machinist's hammer.
1 0373 16 oz. plomb machinist's hammer.
1 HF 252 9-oz. plomb rivet hammer.
1 Claw hammer.
1 No. 51 Stanley screw driver.
1 No. 20-4″ Stanley screw driver.
1 No. 20-6″ Stanley screw driver.
1 No. 20-8″ Stanley screw driver.
1 No. 55-8″ Stanley screw driver.
1 No. 150-1″ Socket firmer chisel.
1 No. 732 Millers Falls brace.
1 62T 14/16″ Irwin bit.
1 62T 18/16″ Irwin bit.
1 No. 10 Wright expansion bit.
1 No. 1047 Crescent hack saw.
1 No. 2 10″ Disston compass saw.
1 No. 2-4″ Armstrong 'C' clamp.
1 7″ Crescent circular snips.
1 No. 1973-7″ Graeuter pliers.
1 No. 200-5″ Pexto pliers.
1 No. 250-6″ Pexto pliers.
1 No. 2611-6½″ Kraeuter diagonal pliers.
1 No. 15A-½″x14″ P. & C. lining bar.
1 No. 55C-⅛″ P. & C. pin punch.
1 55E-3/16″ P. & C. pin punch.
1 No. 55-¼″ P. & C. pin punch.
1 No. 55-5/16″ P. & C. pin punch.
1 No. 10A-¼″ P. & C. cold chisel.
1 No. 10D-½″ P. & C. cold chisel.
1 No. 10F-¾″ P. & C. cold chisel.
1 No. 60C-⅜″ P. & C. diamond point chisel.
1 No. 70C-⅜″ P. & C. round nose chisel.
1 No. 5001E putty knife.
1 No. D7 button taps and dies.
1 No. 00 Toledo pipe die and stock set.
1 set ⅛″, ¼″, ⅜″, ½″, ¾″ pipe taps.
1 No. 38 C&L blow torch.
2 No. 14K Kennedy tool box.
2 No. 1017 Kennedy tool box.
1 Eveready flashlight.
1 Small Dollie Bar.
2 pcs. Canvas 3'x6'.
1 pc. canvas 5'x9'.
1 U gauge.
1 level.
1 set shank drills.
1 assortment files.
1 soldering copper.
1 assortment cotter keys.
1 assortment stove bolts.
1 assortment cut washers.
Paint brushes.
Assortment of enamel and lacquer.
Aluminum bronze.
Sand paper.
Emery cloth.
1 h.p. curb key.
1 set 4 hex. set screw wrenches, ⅛ to 3/16.
1 set Vilger hex. wrenches, No. 50, No. 51, No. 52 (for washing machines).
1 spec. hold-tite Miller screw driver.
1 spec. Easy washer wrench.
1 pr. spring clutch pliers for Easy washers.

Plan Course in Domestic Gas Appliances

A COURSE in Domestic Gas Appliances and Home Service Conference will be held at the American Gas Association Testing Laboratory in Cleveland, Ohio, June 15 to 17, under the sponsorship of the A. G. A. Home Service Committee of which Miss Hulda Ungericht, Ohio Fuel Gas Co., Columbus, Ohio, is chairman. The two and one-half day conference planned for this year is taking the place of the week's short course in domestic gas appliances held in former years at the laboratory, according to Jessie McQueen, home service counsellor of the American Gas Association.

Jessie McQueen

Miss Ungericht is being assisted in planning the conference by Miss Ada Bessie Swann of the Public Service Electric & Gas Co., Newark, N. J., chairman of the educational subcommittee of the Home Service Committee. Miss Swann will have direct charge of the course. F. R. Wright, publications editor of the A. G. A. Laboratory will have charge of the lectures by the laboratory staff, and of the local arrangements.

Speakers from many branches of the gas industry are scheduled for the several sessions, including R. M. Conner, director of the Laboratory, Hugh Cuthrell, manager new business department, Brooklyn Union Gas Co., Brooklyn, N. Y.; R. W. Gallagher, president, East Ohio Gas Co., and president, A. G. A..; Earle W. Hodges, director of public relations, Henry L. Doherty & Co., Keith Clevenger, director of publicity and advertising, A. G. A., E. M. Tharp, assistant general manager, Ohio Fuel Gas Co., Columbus, Ohio; Miss Katharine Fisher, director of Good Housekeeping Institute, New York, N. Y.; Miss Clara Zillessen, advertising manager, Philadelphia Electric Co., Philadelphia, Pa.; Miss Ruth Kleinmaier, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.; Karen Fladoes, Equitable Gas Co., Pittsburgh, Pa., and many others.

Members of the staff of the Testing Laboratory will take a leading part in the Conference, and will act as instructors in the course, including R. M. Conner, director, K. R. Knapp, chief engineer, Dr. F. E. Vandaveer, supervisor, F. R. Wright, publications editor, K. H. Flint, chief inspector Wm. Smith, testing engineer, C. S. Stuckenholt, laboratory foreman, F. H. Rutherford, testing engineer, and W. R. Teller and W. P. Cook, research engineers.

Subjects for discussion in addition to analyses of appliances, include the following: "Load Value of Home Contacts," "Home Service and Advertising," "Comparison of Gas and Electricity," "Surmounting Domestic Competition," "Load Value of Kitchen Planning," "Gas Refrigeration," and "How Variables in Different Forms of Gas Affect Appliances".

Asks Franchise at Timpson, Texas

O. B. Siler of Logansport, La., has applied for a franchise to serve natural gas in Timpson, Texas. Mr. Siler is reported to plan filing of applications in Center and Tenaha. He was recently granted a permit in Logansport and is serving gas there.

THE EVENING NEWS, SAN JOSE, CALIFORNIA, FRIDAY, APRIL 8, 1932

Showdown On Economy Set By President

Automatic Control Aids Cooks

House Passes New Railroad Rate Ruling

Farmers Seeking Power Cost Cut From Commission

Proposal To Split Island Authority Hit

Device Aids Housewives

Magazine Writer Held On Bad Check Charge

Financier Seeks Truce in Rubber War Competition

Clarity Officials Of S. F. Are Threatened

LOS GATOS NOTES

This Week Is Your Opportunity

To Buy a Modern Gas Range

You can save $16 on the purchase of an up-to-the-minute Gas Range with Oven Heat Regulator if you buy this week

Dealers in Gas Ranges are exhibiting the newest models during the week of April 11th. Go into any store where the ranges are on display, and you will find a courteous attendant who will gladly show you the 1932 improvements and answer all your questions.

Ask about the Oven Temperature Control. This is a feature of the Modern Gas Range which assures perfect as well as carefree baking.

If you wish to buy a gas range, this is the Week of Opportunity . . . Gas Range Week, when the newest and finest ranges can be bought at a most substantial and attractive saving. You are cordially invited to inspect the ranges without any obligation on your part.

ASK YOUR DEALER TO SHOW YOU THE NEWEST MODELS

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

Owned · Operated · Managed by Californians

SAVE $16

NOW On This Fine

Buck's Gas Range

Special Gas Range Week Price $102

Regular Price $118.00
Save Price of Oven Heat Control 16.00

Special Gas Range Week Price $102.00

NOTE FEATURES

—16-inch oven—insulated top and door.
—Full Porcelain throughout.
—Big Kitchen Heater.
—Robertshaw Automatic thermostat oven heat control. EASY TERMS SPECIAL
—Newest Console design.

HART'S

Hart's Give S. & H. Green Stamps

Save $16 This week only!

Oven Heat Regulator Included Free

with every Kitchen Heater Type Gas Range priced at $110 or more, or every straight Gas Range priced at $98 or more. This offer good only during

Annual Gas Range Week

April 9 to 16

It will be decidedly to your advantage to buy your new Gas Range during Annual Gas Range Week. The very latest Console model of both the Buck's and Occidental lines are shown at Redstone's, all featured at the astonishingly low 1932 prices. And when the Free Thermostat is featured on these new models, an opportunity is presented that thrifty buyers will not overlook.

This New All-Porcelain Console

Regular Price $129.50
Thermostat Allowance 16.00

This week Only $113.50

See this new Occidental Gas Range! There take advantage of our offer—obtain the $16 Robertshaw Oven Heat Control absolutely Free!

And compare the value! Besides the oven heat control, this new Console has every modern feature —porcelain enamel stove top, new vented burners, sliding broiler drawer, porcelain enamel oven, concealed manifold and full 16-inch oven and broiler. Buy this new Console this week. Long, convenient terms make this easily done.

This same Range without kitchen heater, regular $99.50, this week $83.50—Heat Regulator Free!

"Saxon" 3-piece Group, *special* $99

This group, as sketched above, includes the Bed, High-boy and choice of Dresser or Vanity. For the same group including Twin Beds the special price is $122.75. . . . An outstanding value—the first time this group has been offered in San Jose at a price so low. Pieces may be purchased separately at the prices listed below.

Bed . . $24.75 Vanity . . $41.75 Chest . . $32.50 Night Cabinet . . $12.50 Dresser . . $41.75 Bench . . $10.25

TIE-IN ADVERTISING

Records show that dealers ran 254 advertisements in conjunction with 50 gas appliance advertisements sponsored by this Company during the period from February 15 to May 15, 1932. These 254 dealer tie-in advertisements amounted to nearly fourteen full newspaper pages of 160 column inches each.

Records also show that dealers who use tie-in advertising are rapidly increasing their number of prospects and sales. What tie-in advertising has done for others it can do for you.

The steps are as follows: Examine the reproductions of forthcoming appliance advertisements contained in the circular which is mailed to you each month by this Company. *(If you are not receiving this advance information now, call or write our Publicity Department, 245 Market Street, San Francisco, and have your name placed on the dealer mailing list).* From the reproductions in this monthly circular, select the advertisements that will help you. Call your local newspaper offices to find out if the advertisements you have selected will appear in your city and WHEN they are to be published. Publishers of your local newspapers will be glad to help you PLAN, PRINT and PROFIT with TIE-IN ADVERTISING.

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

Owned · Operated · Managed by Californians

WG-206-632

Training and Functions of Metermen

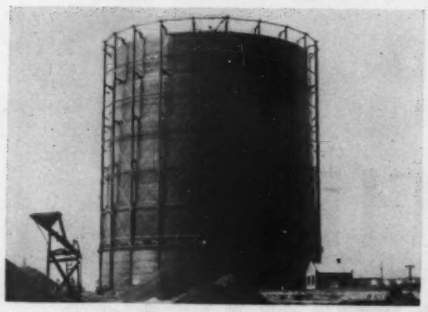
(Continued from Page 34)

of their tools and the condition of each tool that is in their possession. From this report we check back against a list which we consider standard equipment for our meter inspectors.

Up to this point I have set out as nearly as possible the duties that we know a meter inspector is going to perform in the course of a month or three months, but there are numerous other things that he has to do which do not fall under the regular routine. However, we all know that with any mechanical device we are going to have a certain amount of upkeep. Each month our meter inspectors spend considerable time on emergency repair calls. We have found that a greater portion of the trouble-shooting can be eliminated if on each inspection the meter inspector is careful to see that every meter is working properly. It of course is highly impossible to anticipate when a clock is going to stop or when a pressure tube may blow out, but these occurrences are so infrequent that they are negligible. Most other emergency trips could probably be eliminated by proper periodical inspection. During the summer months when the days are long and weather conditions permit a meter inspector to cover his territory more quickly, there is plenty of time for painting and completely overhauling each installation. Not only is it of benefit to the meter to keep it neat in appearance, but is also a medium by which the meter inspector's superior can best judge his work.

Along with the meters and the responsibility placed upon the meter inspector, the company has intrusted considerable other property to the inspector, such as an automobile and various other equipment. It has been proven in our company that the men who take the best care of their cars also have been found to do the best work on their regular meter inspection.

NO-OX-ID IRON-RUST
The Original Rust Preventive



In Gas Holder Protection

NO-OX-ID WATER SEAL has great service superiorities in that the lifts do not have to be lowered at any regular intervals and it does not build up thick, unsightly coatings on lifts that dip frequently.

NO-OX-ID FILLER RED is semi-drying on the surface, offering an excellent bond for paint (especially aluminum), while beneath the surface the FILLER remains a plastic, protective rust inhibitor.

Complete details and recommendations on request.

DEARBORN CHEMICAL COMPANY
LOS ANGELES:
807 Mateo Street, Phone TRinity 3385
SAN FRANCISCO
421 Bryant St., Phone SUtter 8688

"Antileke"

The hypo-sealed pipe joint saves 20% to 50% in laying cast iron or steel pipe and repairing any ordinary or difficult gas leaks.

Thousands in use without a single failure.

GAS & ELECTRIC FACILITIES, LTD.
447 Sutter St., San Francisco

Send literature and prices on "Antileke"

Name.....

Address.....

City.....State.....

GENERAL CERAMICS COMPANY
71 West 35 Street, New York, N. Y.
REFRACTORIES FOR GAS APPLIANCES

Genceraco Refractories are made in all shapes and sizes, in color, decorated or plain and in any quantity. They may be had in dense as well as porous material.

Extremely resistant to thermal shock and are physically strong. We will gladly send you a quotation on your requirements.

To Study Oklahoma City Fields Potential Supply of Gas

A Federal government survey of gas potentialities in the Oklahoma City field to determine to what extent it may rely on the field for fuel is being planned.

Scott Turner, director of the Bureau of Mines, said a field man would be sent to Oklahoma City soon to conduct the survey, which will be the first of its kind undertaken by the government since the discovery of oil and gas in the field.

If the regular procedure is followed, the government bureau will call on its experimental station at Bartlesville, Okla., to assist in the survey. The work will include studies of oil and gas production horizons, porosity of sand, rock pressure, gas volume and the amount dissipated since the field was discovered.

Handbook of deLavaud Pipe Ready for Distribution

United States Pipe and Foundry Co., Burlington, New Jersey, announces the publication of its "Handbook of deLavaud Centrifugally Cast Iron Pipe". The booklet contains revised specifications and dimensions and weights of deLavaud pipe in accordance with Federal Specifications for pipe; Water, Cast Iron (Bell and spigot) No. WW-P-421. The brochure is well illustrated with diagrams and with photographs showing de Lavaud pipe in use. Copies may be obtained by addressing the company.

Owatonna, Minn., Votes for Municipal Natural Gas System

The City of Owatonna, Minn., has voted to distribute natural gas through municipally owned mains, supply coming from the lines of Northern Gas and Pipe Line Co. Interstate Power Co., with Minnesota operating headquarters in Rochester, is now serving manufactured gas in the town.

Refrigerator Sales Gain 31 Per Cent.

Sale of Electrolux refrigerators by Southern California Gas Co., Los Angeles, for the first four months of 1932 showed an increase of 31 per cent over the corresponding four months of 1931.

W. F. Brandt Dies Suddenly

W. F. Brandt, assistant foreman of the gas distribution department of the Los Angeles Gas and Electric Corp., Los Angeles, Calif., passed away suddenly at his home on May 3.

Worthy of the TENTH OLYMPIAD . . .

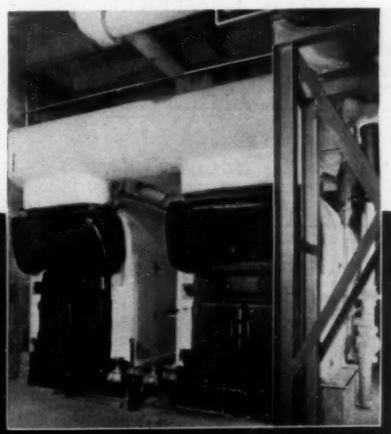
WHEN STAR athletes of all the world flash through the clear, illuminated water of the sparkling pool specially constructed for the Tenth Olympiad, their health and safety will be guarded by the worthiest equipment known to engineering skill . . .

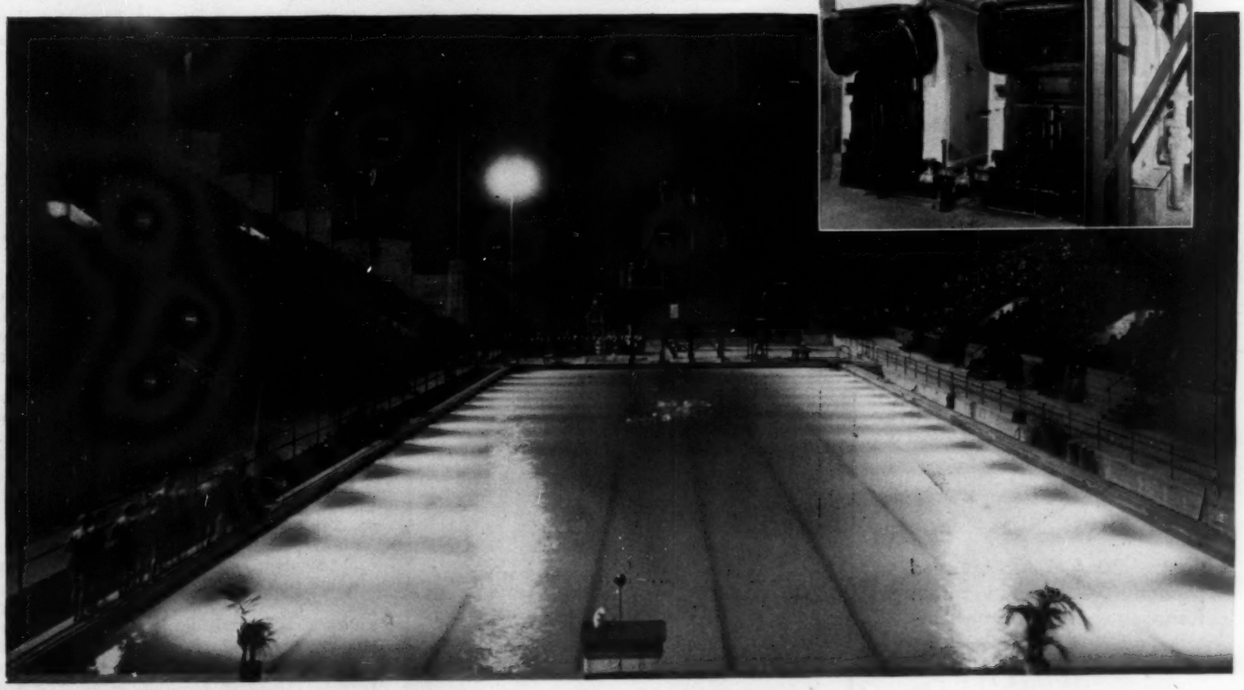
Built to exacting Olympic tradition, the pool is 165 feet long by 67 feet wide, varying from 17 to 6 feet deep. Ten thousand persons may be seated in the two grandstands, of which one will be removed after the Games to make room for the semi-circular Children's Pool 160 feet in diameter.

Each eight hours the 840,000 gallons of water in the Olympic pool is pumped through sand filters and thoroughly purified . . . while the gleaming white tile tank is periodically made spotless with a modern suction system resembling a much oversize vacuum cleaner . . .

Correct temperature is maintained independently of the weather by a copper-tube heater, with steam supplied from two boilers equipped with N. G. E. gas burners Type HW.

Two 100 h. p. Oil City portable firebox type boilers, each equipped with 38 N. G. E. Type HW gas burner heads. Uniform steam pressure is automatically maintained by a 4-inch Wilgus-N. G. E. Gas Fuel Regulator Type G-1 shown at right of picture.

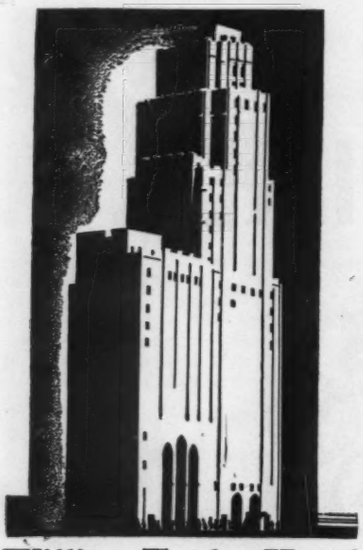




NATURAL GAS EQUIPMENT INC.

Los Angeles . . . . . Petroleum Securities Building
San Francisco . . . . . 1123 Harrison Street
Butte, Montana . . . . . Heating Assurance Inc.

Western Distributors for SURFACE COMBUSTION COMPANY ◆ WEBSTER ENGINEERING COMPANY



William Taylor Hotel

Most Distinctive Hotel of San Francisco

Also operating

HOTEL WHITCOMB
at CIVIC CENTER

WOODS-DRURY CO., *Operators*
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WILLIAM TAYLOR
HOTEL *at Civic Center*
SAN FRANCISCO

NOW is an opportune time to install larger capacity pipe in place of inadequate mains laid generations ago. To create constructive employment is a sound relief measure. To take advantage of present low costs of labor and materials is wise economy in the public interest. Broad-gauged programs for lowering taxes will include starting *permanent* projects now while costs of construction are *temporarily* depressed.

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Cast Iron Pipe

United States Pipe and Foundry Co., Burlington, N. J. Sales Offices: New York, Buffalo, Cleveland, Chicago, Philadelphia, Pittsburgh, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, Los Angeles, San Francisco

One of 20 A.G.A. approved products — including floor furnaces, basement furnaces and console heaters

Manufactured by

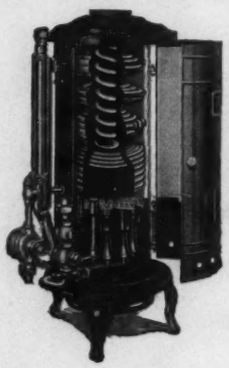
Fraser Furnace Company

Stockton, Calif.

Distributed by

H. R. BASFORD CO. San Francisco, Los Angeles

HOFFMAN



Our unbeatable combination of High Quality and Low Price means extra dollars for you. Write us today.

THE HOFFMAN HEATER COMPANY

1701 Dixie Highway
Louisville, Kentucky

Rate Case Settled in Favor of Community Natural Gas Co.

Litigation involving rates of the Community Natural Gas Co. of Dallas in the city of Eastland, Texas, was cleared from the federal court April 15, when Judge James C. Wilson handed down decision favoring the gas company in two cases.

He overruled a motion by attorneys for the city to dissolve an injunction secured by the Community Natural, restraining Eastland officials from interfering with the promulgation of a "fair and equitable" domestic rate. The court order was issued last year, under which the gas company instituted a new sliding scale of rates. Effect of the decision will be to allow continuance of that rate.

The new rate, which supplants a 75 cent per 1,000 cubic feet flat charge, is $1.50 for the first 1,000 feet, $1.25 for the second, 75 cents for the third, 50 cents for the next 17,000 feet and 45 cents for all gas used in excess of 20,000 feet.

RegOroD is New Product of Bastian Blessing Co.

The Bastian-Blessing Co., Chicago, Ill., has recently introduced a new line of welding rods and electrodes to be sold under the trade name of RegOroD through Rego distributors.

Bundles are identified by a shield tag in red and black which bears the trade-mark and the identification symbols.

A new catalog describing RegOroD has been prepared in pocket size, giving description of each rod and information in reference to the proper rod for use in specific applications. It also contains a number of tables for the use of the welder and welding engineer.

Bastian-Blessing Co. and Rego distributors will furnish a copy of this catalog and handbook on request.

Summer Course in Gas Appliances Scheduled for July 5-22

As has been the custom for several years past, a summer course in household gas appliances will be held at Columbia University, New York, July 5-22, with the cooperation of the American Gas Association. Dr. C. J. Lynde, head of the department of household engineering, will conduct the course, assisted by T. H. Schleuning, engineer of the Consolidated Gas Co., New York. Class work will occupy the morning sessions. Afternoon programs will feature food and nutrition lectures by members of the Home Economics department of Columbia and field trips to the various home service departments around New York.

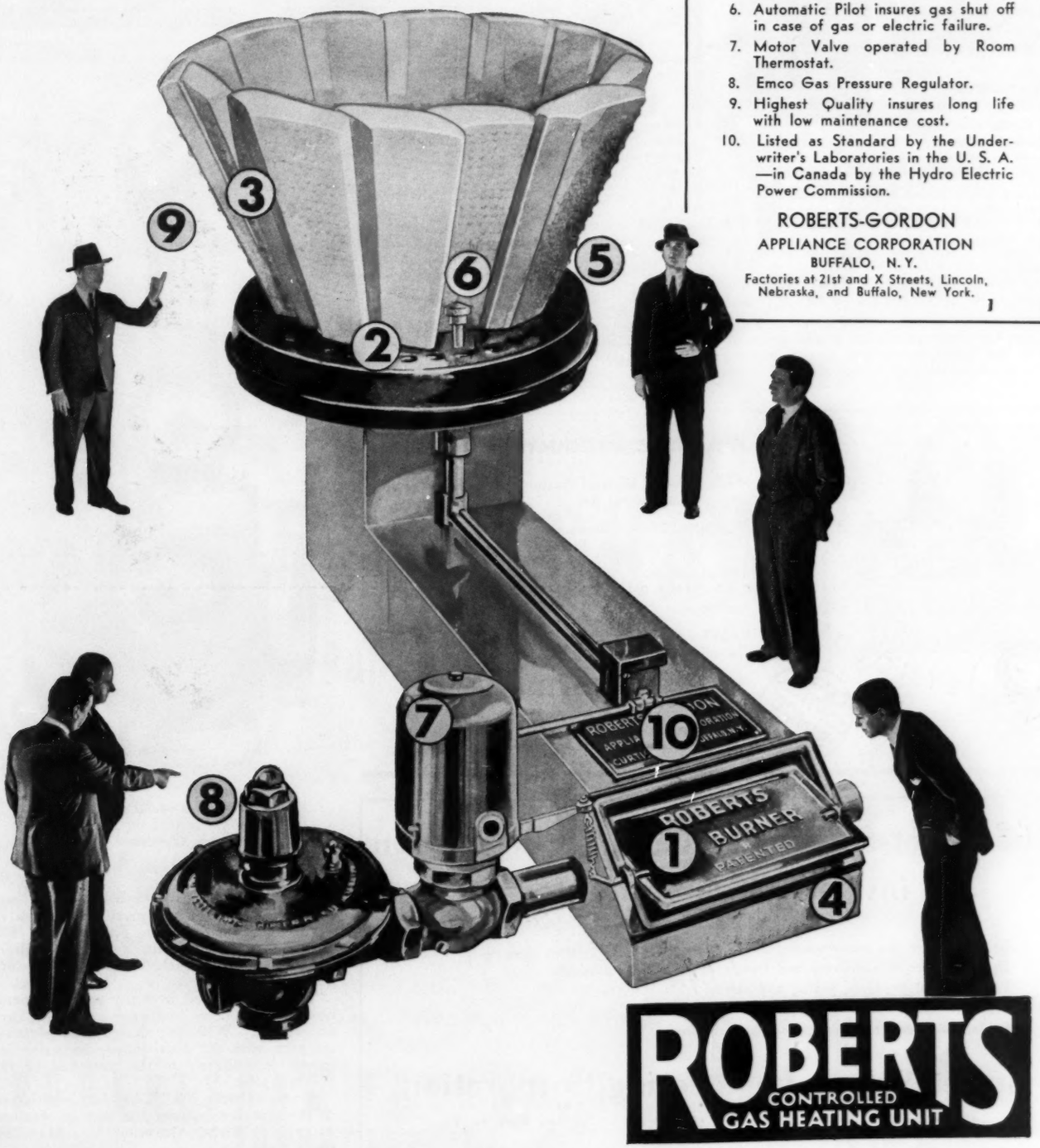
Line Under Way to Serve Orosi, Cutler and Sultana

Construction operations have been started on the Orosi-Cutler main extension for Southern California Gas Co. Thompson Bros., Fresno, are doing the work. The extension will add three new communities to the territory served by Southern California Gas Co., namely Sultana, Orosi and Cutler. Approximately 10 miles of line is being laid for the new service.

Production in Texas Restricted

Restricted production of natural gas in the Texas Panhandle was ordered May 9 by the Texas Railroad Commission. The order, which went into effect May 15, is expected to save 150,000,000 cubic feet of gas per day.

Ten Reasons for Roberts superiority



Ten Features of the Roberts Controlled Gas Heating Unit

1. Complete Air Control prevents cold air entering and cooling fire pot when the burner is not in operation.
2. Roberts Burners minimize excess air, by directing all air to point of combustion.
3. China Clay Radiants direct heat against walls of fire pot.
4. Special Steel Mixing Tubes permit 30% higher injection of air than cast iron.
5. Preheated Air Increases Combustion Efficiency.
6. Automatic Pilot insures gas shut off in case of gas or electric failure.
7. Motor Valve operated by Room Thermostat.
8. Emco Gas Pressure Regulator.
9. Highest Quality insures long life with low maintenance cost.
10. Listed as Standard by the Underwriter's Laboratories in the U. S. A. —in Canada by the Hydro Electric Power Commission.

ROBERTS-GORDON
APPLIANCE CORPORATION
BUFFALO, N. Y.
Factories at 21st and X Streets, Lincoln, Nebraska, and Buffalo, New York.

ROBERTS
CONTROLLED
GAS HEATING UNIT

Production Factors Need Correlation

A general statement relating to gas and oil production in California was released late in May by Claude C. Brown, gas and electric engineer for the California Railroad Commission, in part as follows:

"Within the last few years, through voluntary curtailment of both oil and gas production, through the expansion of the quantity of gas used, the number of consumers using it, the area served and the additional uses found for it, and due to the vigorous administration of conservation legislation by the State, the amount of gas wasted has been very materially reduced. The following tabulation sets forth the results of these influences:

C. C. Brown

	Total M.C.F. per Year 1929	1930	1931
1. Production (net)	557,634,000	544,765,000	385,201,000
2. Sales to Utilities	119,727,000	141,385,000	168,965,000
3. Field use and other uses	189,430,000	182,388,000	147,758,000
4. Blown to Air	248,477,000	220,992,000	68,478,000

"From the above tabulation it will be noted that in the three-year period the production of gas has been reduced 31 per cent, the total utilization has been increased 2½ per cent, the sales to utilities increased 41 per cent and the wastage reduced 72 per cent. There was, during the month of March of this year, an average daily blow to the air of 45 million cubic feet of gas as compared with one billion cubic feet in October, 1929, a reduction of 96 per cent."

The statement points out that defeat of the Sharkey measure at the polls last month leaves the situation as before, with oil producers free to produce as they see fit, modified by such voluntary curtailment agreements as they may effect, and by the State's restrictions upon gas wastage. Virtually no correlation exists between gas production and demand. In the interest of gas conservation gas production must vary seasonally with demand, and since oil and gas production are inseparable, oil production must vary with it. Oil is more susceptible to storage than gas, though there is a limit to economic storage of oil.

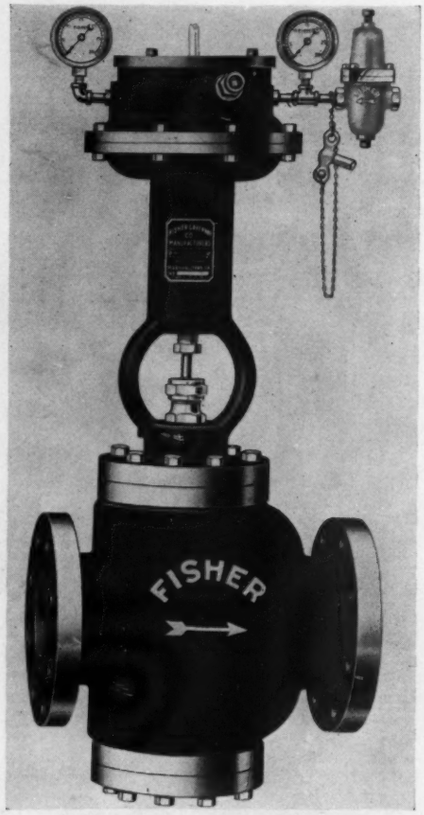
The problem is intricate and demands effective correlation of the many factors involved. Suggesting one direction in which correlation might be sought, the statement concludes:

"Other industries have found it necessary to create agencies consisting, in some cases, of a single individual, upon which is put the responsibility of creating and maintaining the control of their diversified problems.

"Were similar action taken in this case, such agency or individual should be thoroughly familiar with the problems of the oil industry and the public utility gas distributing companies, the regulations under which each operates, the problems of production, utilization and wastage of both gas and oil and should have the ability and authority (granted by each industry) to correlate the supply and demand of these commodities with the minimum of waste and the maximum benefit to the owners that lease the land, the oil industry that produces the commodities, the gas utilities and others that distribute them, the public that consumes them and the State that taxes them."

New Wizard Pilot Control Announced by Fisher

FISHER Governor Co. just announced the development of the Series 4200 Wizard pilot unit which involves a new design that includes the pilot valve as an integral part of the main valve top work. This unit utilizes auxiliary air or gas as an operating medium and is designed to meet pressure conditions of 5 pounds and up.

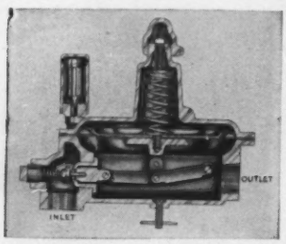


The new Series 4200 Wizard Pilot Unit, recently placed on the market by Fisher Governor Co.

The unit may be converted from a pressure reducing valve to a pressure relief valve by a change made in the pilot valve. It is furnished complete with a small auxiliary regulator shown attached and with pressure gauge.

This unit is used in many refinery operations where close limits of regulation are maintained. With the design incorporating the pilot with the main valve, the valve responds immediately to the command of the Wizard pilot.

A new bulletin, No. 70, has just been issued on the new development and may be obtained by writing Fisher Governor Co., Marshalltown, Iowa.



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GAS CONTROL SINCE 1892

Reynolds Products—

Products for all kinds of Pressure Reduction—for either artifiicial or natural gas.

GOVERNORS—Intermediate Pressure, Triple Outlet, Holder, Toggle Type Street.

REGULATORS—High Pressure Service, Low Pressure Service, High Pressure Line, Single and Double District Station.

VALVE—Automatic, Quick-Closing Anti-Vacuum, Relief, Cut-off.

Reynolds Gas Regulator Co.

Anderson, Indiana

422 Dwight Building—Kansas City, Missouri
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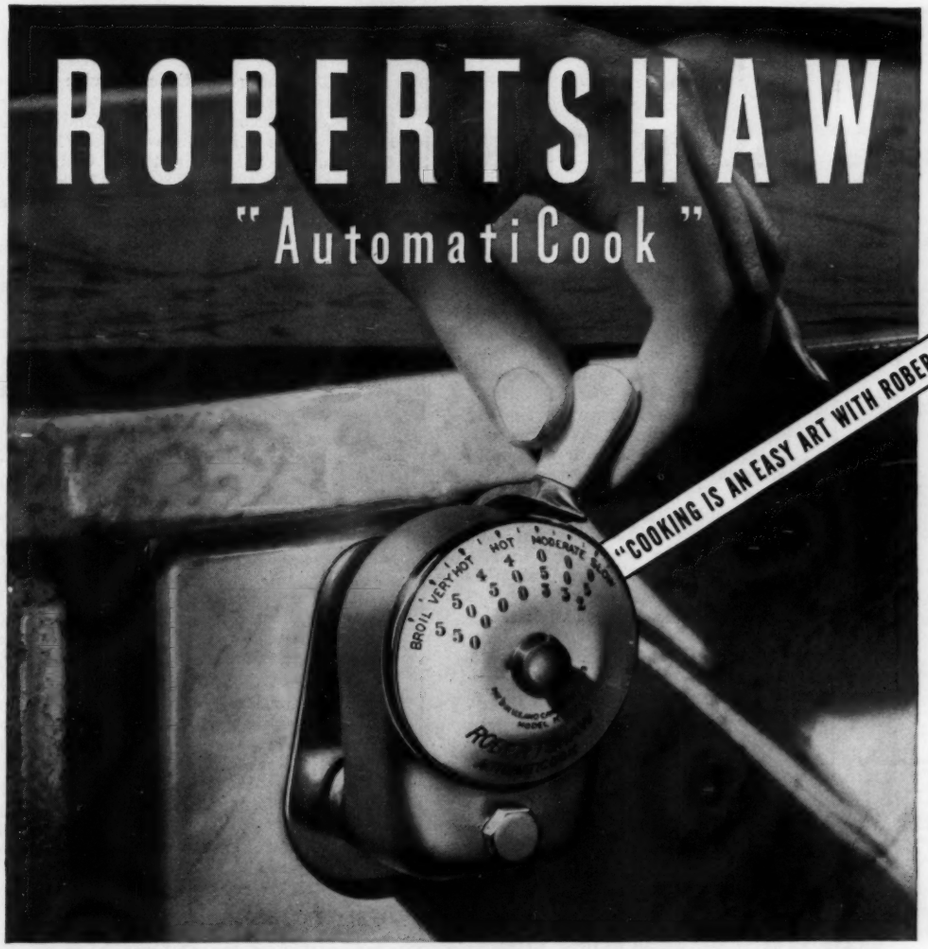
invites your inquiries for

Equipment for the manufacture, cleaning and handling of gas.
Equipment for the recovery and treatment of coal by-products.
Welded steel products, piping and valves.
Producer gas and blue gas apparatus.
Engineering service, investigations and reports.

Semet-Solvay Engineering Corporation

40 Rector St. New York, N. Y.



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FOR CONSOLE RANGES

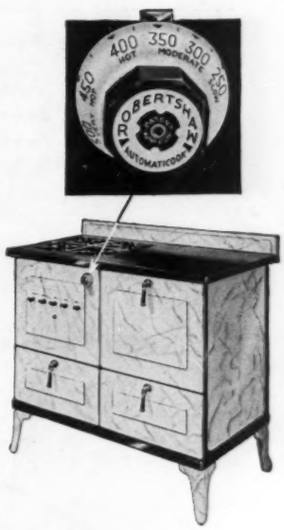
The ROBERTSHAW
is Your Best Range Salesman . . .

This year, you are able to offer your trade the greatest range values in history.

But don't forget that value is a word that means much more than price.

And value . . . in a gas range . . . is a matter of *performance* just as much as appearance . . . which means, above all else, *correct oven control.*

That is why the Robertshaw is such a good salesman for you . . . your customer knows that it assures her receiving the last word in accurate, dependable, trouble-free performance. And that's a BIG point to remember, whenever you order ranges this year.



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FOR TABLE TOP AND CONSOLE RANGES

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A Straight A. C. Valve
Absolutely Noiseless
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DON'T OVERLOOK
The Little Fellow

Sandwich shops, road stands, beach and resort concessions may not spend a lot for gas appliances or for gas individually, but collectively they are a whale of a big market. The new Madsen 2-in-1 Griddle-Broiler Combination is going big in this market. Highly polished griddle plate on one side, corrugated broiler plate on the other, all at a price the small operator can easily pay . . . and very truly making money for owners "right and left." Write for details and prices on this unit.

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Apartments from $75 a Month
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Modern, Home-like and
Supremely Comfortable

LOS ANGELES

Cities Service Co.'s Annual Report Optimistic

NET earnings of Cities Service Co. and its subsidiaries for 1931 amounted to $63,106,000, according to the 22nd Annual Report. This compares with $69,734,000 in 1929 and $84,862,000 in 1930. Consolidated gross earnings for 1931 were $177,046,000 as compared with $185,851,000 in 1929 and $213,036,000 in 1930.

Gross earnings of the natural and manufactured gas utilities were $39,747,000 in 1931, as compared with $39,169,000 in 1929 and $42,496,000 in 1930.

Total assets of the organization on December 31, 1931, amounted to $1,312,256,000, as compared with $1,282,624,000 at the end of 1930. Consolidated current assets were $115,665,000, including $41,817,000 in cash.

During 1931 there was expended $55,000,000 in new construction and property acquisitions. The major expenditures were made on projects initiated prior to 1931, and included a participating interest in the natural gas pipe line from the Texas Panhandle to Chicago; the construction of Sixty Wall Tower, the company's new office building in New York City; necessary developments in the East Texas and Oklahoma City oil fields, and the expansion of electric generating and transmission facilities, including acquisition of public utility properties.

The number of customers for natural and manufactured gas was increased in 1931 from 508,316 to 530,882 and the miles of gas mains from 14,885 to 15,416.

The year 1931 witnessed the completion of the 900-mile 24-inch Texas-Chicago natural gas pipe line of Natural Gas Co. of America, in which Cities Service Co. has a 26.6 per cent interest.

W. R. Stevens Appointed General Auditor of Lone Star

W. R. Stephens, formerly chief clerk of the Community Natural Gas Co., Dallas, Texas, has been made general auditor of the Lone Star Gas Co., succeeding Jack Grissaffi, who died recently. Guy O. Tribble has been appointed to fill Mr. Stephens' place.

W. R. Payne of the accounting department, Lone Star system, has recently been made chief clerk, following the death of John R. Heslep.

Big Sioux Power Plant to Change Over to Natural Gas

Change-over operations were scheduled to begin sometime the latter part of May at the Big Sioux Power plant in North Riverside. Plans call for an expenditure of about $200,000, including construction of a line to the power plant from the Northern Gas and Pipe Line Co.'s line to the Cudahy Packing plant. Change-over operations are under way by Sioux City Gas and Electric Co., Sioux City, Iowa.

Excelsior Springs Line Soon to Be Placed in Service

Operations are well under way on Missouri Power & Light Co.'s natural gas transmission line from fields near Liberty, Mo., to Excelsior Springs, Mo. The line will be approximately 10 miles long. The city is at present served with water gas by the company which is a subsidiary of North American Light & Power Co., Chicago, Ill. R. H. Kenning, company engineer, is in charge of operations.

Dehydrating Alfalfa

(Continued from Page 21)

during the alfalfa drying period it is estimated that a plant of this size will take care of approximately 800 acres.

Use of these dehydrating plants means a new day for alfalfa production in this section. The uniform, high grade finished product results in a very substantial increased return to the growers. The dehydrator will contribute in an important way to off-setting the one-crop system of cotton raising in the Mississippi Delta.

Superior Water, Light & Power Co. to Extend Service to Suburb

Superior Water Light & Power Co., Superior, Wis., has received a petition signed by 304 residents of Itasca and Allouez, Wis., asking the company to extend gas mains to that district. According to statements credited to W. C. Lounsbury, general manager of the company, a study of the territory is being made. The company had previously agreed to extend service if 300 sigaatures were secured.

E. A. Stowe Named District Agent for So. Cal. Gas Co.

E. A. Stowe has been appointed district agent for Southern California Gas Co. with offices at Banning, and will have charge of operations in Banning, Palm Springs, Beaumont, Hemet and San Jacinto. Mr. Stowe succeeds R. E. Sams, who has returned to his work as chief clerk in the San Bernardino office, headquarters for the company's Eastern Division, H. J. McAllister, manager.

Granted Permission to Operate Line to Amboy, Ill.

Illinois Northern Utilities Co., Dixon, Ill., has been granted permission by the state commission to construct and operate a natural gas transmission line to Amboy, Ill., from fields about 10 miles from town. The company has also been given permission to construct and operate a gas distribution system in the town.

New Dearborn Publications on "No-Ox-Id" Fillers

Dearborn Chemical Co., Chicago, Ill., recently brought from the press a new circular describing the "No-Ox-Id" fillers manufactured by the company. The brochure is attractively styled and well illustrated. Copies may be obtained by writing to the company at 310 South Michigan Ave., Chicago.

Panhandle Illinois Pipe Line Co. Opens District Office at Pittsfield

Panhandle Illinois Pipe Line Co. has opened maintenance headquarters in Pittsfield, Ill., with J. Russell Dewees in charge as district manager. Mr. Dewees was formerly at the Jacksonville office of the company. Operation of about 100 miles of main line and laterals will be directed from Pittsfield.

McCallum Moves Headquarters

E. A. McCallum, representing Roots-Connersville,Wilbraham, Connersville, Ind., has moved his offices from Los Angeles, Calif., to San Francisco.

Sprague Semi-Chrome Leather

Resists Acids
and Boiling Water

Now Used in All

Sprague Meters and Regulators

May we send you samples and data?

The Sprague Meter Co.

BRIDGEPORT, CONN.

Los Angeles, Calif., San Francisco, Calif.

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The Goodman Stopper

The Reliable Shut-off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

Safety Gas Main Stopper Co.
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Pac. Coast Rep.: C. B. Babcock Co.
135 Bluxome Street
San Francisco, California

A Line That Covers Every Prospect

The complete Johnson line of Conversion Burners includes a type for every furnace, a size for every home, and a price for every purse. There are six different basic burners ranging from the smallest Johnson Junior to the big Johnson Automatic. A large variety of optional equipment (thermostatic or chain control, baffle assemblies, etc.) further increases the flexibility of the line. Get a catalog and compare the Johnson line with any other—write today for your copy.

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Cedar Rapids IOWA

Pacific Coast Representative—C. B. BABCOCK CO.
135 Bluxome St., San Francisco, Calif.

2 plates

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Classified Advertising

Classified advertising five cents per word; minimum $2.00 per insertion. Situation Wanted advertisements up to 50 words will be published three consecutive issues without charge. Small professional cards 1-in. deep by 21 ems wide are $5.00 monthly on 12-time contract.

SITUATIONS WANTED—MALE

Service man, aged 35, with five years experience in manufactured, natural and butane gases, desires position. Applicant is experienced in welding and in installing mains and services. Will go anywhere. Address Box E-197 *Western Gas*, 124 West Fourth Street, Los Angeles, Calif.

Expert meter repairman, shop supervisor with meter maintenance experience desires position. Has had eight years experience repairing and testing ironcase dry gas meters. Has also had experience in regulator repair and meter installation. Applicant prefers to locate in east or south but will consider any location. Good references. Address Box E-199, *Western Gas*, 124 West Fourth Street, Los Angeles, Calif.

University Graduate, age 37, with 15 years utility experience in gas distribution and transmission, steam, diesel and hydro power plant design, detail and supervision, desires position. Applicant has had responsible engineering charge developing diversified utilities. Can offer excellent references as to ability and character. Address Box E-201, *Western Gas*, 124 West Fourth Street, Los Angeles, California.

Auditor and accountant, thoroughly experienced in all phases of public utility and other accounting operations. gas and oil included, desires position. Will locate anywhere. Very moderate salary. Available immediately. Unquestionable references furnished from large national concerns. Address Box E-203, *Western Gas*, 124 West Fourth Street, Los Angeles, Calif.

Executive seeks position as manager of gas property. Experience covers 20 years of both manufactured and natural gas. Can build industrial and house heating load and can handle merchandising and public relations work. Excellent references. Available immediately. Salary desired $3,000. Address Box E-205, *Western Gas*, 124 West Fourth Street, Los Angeles, Calif.

Gas appliance and warm air heating engineer now employed in the East wants to locate in the Pacific Coast or Rocky Mountain region. Experienced in design of gas heating appliances and in designing warm air heating and residential air conditioning systems. Applicant is college graduate, age

32 years. Address Box E-207, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Engineer or office manager, married man, age 31, college training, 10 years with one utility construction company as chief clerk, party chief, draftsman on electric and gas transmission, distribution and operation, hydro, steam and substation work, desires position. Applicant is open to any offer, clerk, dispatcher, transitman, temporary or permanent location anywhere. Excellent record. Address Box E-209, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Single man, age 29, experienced in house heating, commercial building and industrial conversion work, desires position. Applicant is familiar with all types of heating systems and boilers. Experience includes surveying, figuring heat loss, annual gas consumption, boiler load demands, specifying equipment and supervising installations. Now employed as industrial sales engineer. Will go anywhere. Address Box E-211, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Hollopeter Replaces Frizell at Durango, Colo., As Manager

Announcement was made early in April of the appointment of Harry Hollopeter as manager of the Durango Natural Gas Co., Durango, Colo., replacing H. C. Frizell who has been transferred to the office of Southern Union Gas Co., Belleville, Texas. Both companies are subsidiary to Southern Union Gas Co., Dallas, Texas.

May Construct Gas Line to Serve St. Louis Industrials

Reports credit H. L. Ruppert, president of the St. Louis Industrial Gas Co., St. Louis, Mo., with plans to construct a pipe line from fields in southwestern Kansas and Oklahoma to St. Louis, Mo., to supply industrial consumers there. Franchise action is pending in St. Louis.

Ponca Crossing of Missouri River to Be Completed About June 1

Construction of the Ponca, Neb., crossing of the Missouri River by Northern Gas and Pipe Line Co., will be completed about June 1, according to report. The gas transmission line into Sioux Falls, S. D., will be placed on this crossing. At present the pipe is suspended above the river on wires.

Paranite Pipe Joint Gaskets Described in Pamphlet

"History of Rubber Gaskets as Used in Gas Pipe Joints" is the name of a pamphlet by J. E. Skane, and published by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., makers of Paranite pipe joint gaskets. Copies may be obtained by addressing the company at Passaic, N. J.

Southern Counties Gas Co. to Build Additional Storage Holders at Monrovia

Southern Counties Gas Co., Los Angeles, has purchased property for a site for additional natural gas high pressure storage holders adjoining the company's operating plant at Monrovia, Calif. No date has been set for beginning construction operations.

Shielded against Meddling

THE Fulton Spring-Type High-Pressure Regulator is recommended where individual users are to be supplied from a line carrying a pressure too high for a single regulator to hold with safety. It will take any inlet pressure up to 300 pounds and reduce it to any desired pressure between 10 and 50 pounds.

Compact and economical for transportation, simply designed for quick connection or adjustment, heavily and strongly built for durability in use—it is perhaps most of all commended by its safety from accidental or unintentional meddling when in an exposed location. A descriptive leaflet is available. Advice as to application of any C-F appliance gladly given on request.

CF

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28-40 Penn Avenue **Pittsburgh, Pa.**

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REGULATORS

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LIMITED
Pipe Line Construction
ORGANIZATION — EXPERIENCE
RESPONSIBILITY
LOS ANGELES CALIFORNIA

GAS PIPE LINE MAP

Compiled by the Editors of WESTERN GAS—Size 45" x 45"
The most comprehensive published; covers the 22 western states in detail. Gives gas fields, names of natural gas communities; sizes of pipe lines and names of pipe line companies.
Prices: $1.50, Heavy Bond Paper; Printed on Cloth, $3.50
WESTERN GAS
124 West Fourth St. Los Angeles, Calif.

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PACIFIC STATES CAST IRON PIPE CO. PROVO, UTAH

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PORTLAND, ORE. 606 Spalding Building
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Advertisers' Index

American Cast Iron Pipe Company —
American Gas Products Corporation —
American Lava Corporation —
American Meter Company 10-12
American Recording Chart Co. —

The Barber Gas Burner Co. —
H. R. Basford Company 56
A. M. Byers Company —
Byron Jackson Co. 62

J. A. Campbell Company 52
The Cast Iron Pipe Research Ass'n. 2
The Chaplin-Fulton Mfg. Co. 63

Dayton Pipe Coupling Co. 9
Dearborn Chemical Co. 54
Detroit-Michigan Stove Company —
S. R. Dresser Manufacturing Co. 5

Electrogas Furnace Co. —
Electrolux Refrigerator Sales, Inc. 3
The Fisher Governor Co. 4
The Fluor Corporation, Ltd. 1
Forney Combustion Engrg. Co. 63
Fraser Furnace Company, Inc. 56

Gas & Electric Facilities, Ltd. 54
General Ceramics, Ltd. 54
General Controls Co., Ltd. 60
General Paint Corporation 8
James Graham Mfg. Co. —
Groble Gas Regulator Company 39

The Hoffman Heater Co. 56

Johnson Gas Appliance Co. 62

Kerotest Company 40

Linde Air Products Company —

Madsen Iron Works 60
Milwaukee Gas Specialty Co. —
Minneapolis-Honeywell Regulator Co. —

National Transit Pump & Machine Co. —
National Tube Company 45
Natural Gas Equipment, Inc. 55

Pacific Gas & Electric Company 53
Pacific Pipe & Supply Co. —
The Park Wilshire 60
Payne Furnace & Supply Co., Inc. 49
Pittsburgh Equitable Meter Co. —

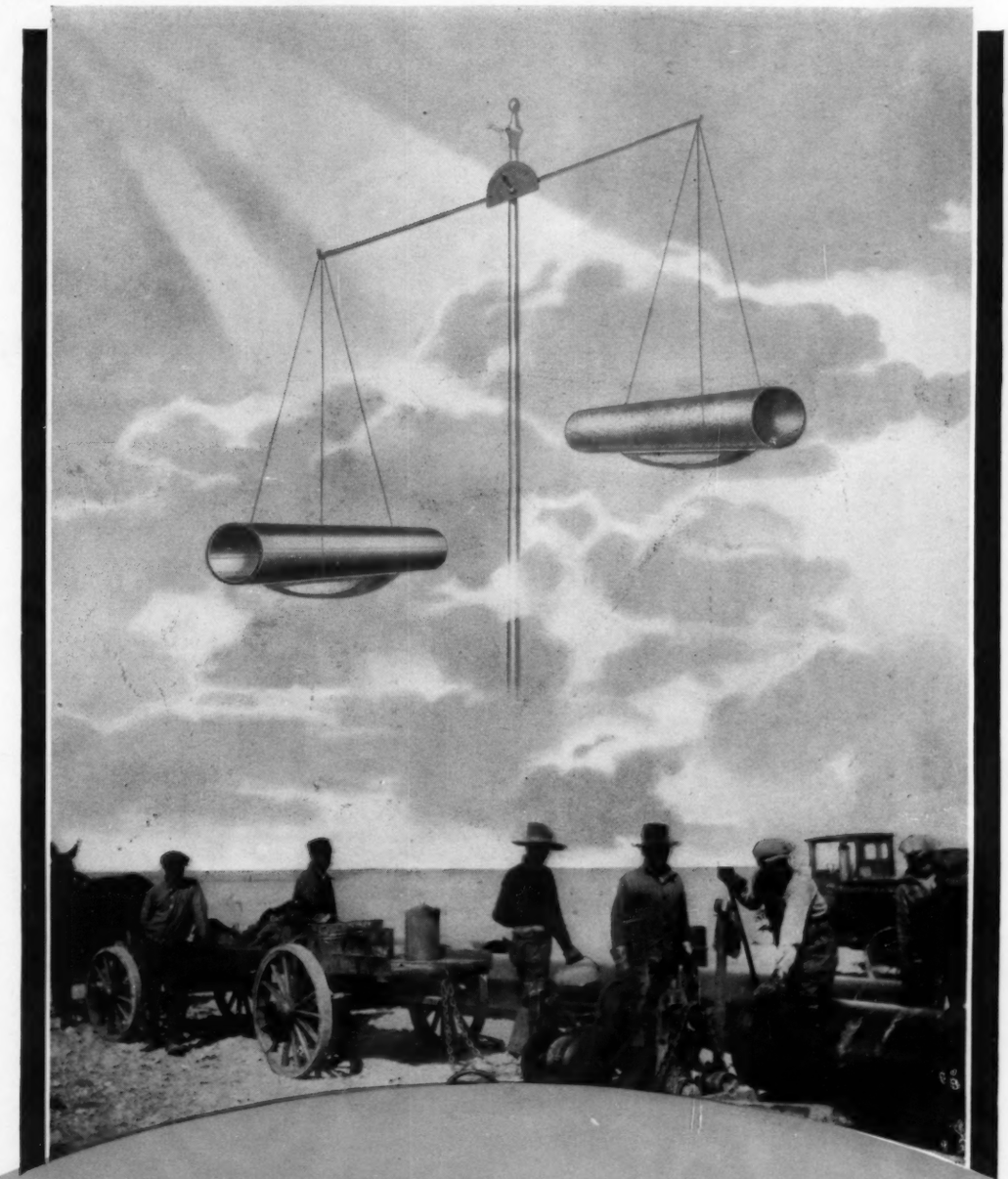
Reliance Regulator Corp. —
Republic Steel Corp. 2nd. Cover
Reynolds Gas Regulator Company 58
Roberts-Gordon Appliance Corp. 57
Robertshaw Thermostat Company 59
Robinson Orifice Fitting Company —
George D. Roper Corp. —

Safety Gas Main Stopper Company 61
Semet-Solvay Engr. Corp. 58
Wm. B. Scaife & Sons Co. 39
South Chester Tube Co. Back Cover
Sprague Meter Co. 61
Standard Gas Equipment Corp. 51

The U. G. I. Contracting Co. —
United States Pipe & Foundry Co. 56

Wailes Dove-Hermiston Corp. 3rd. Cover
Welsbach Co. 47
Western Gas 6-7
William Taylor Hotel 56

WHEN EVIDENCE OUTWEIGHS ALL THEORY



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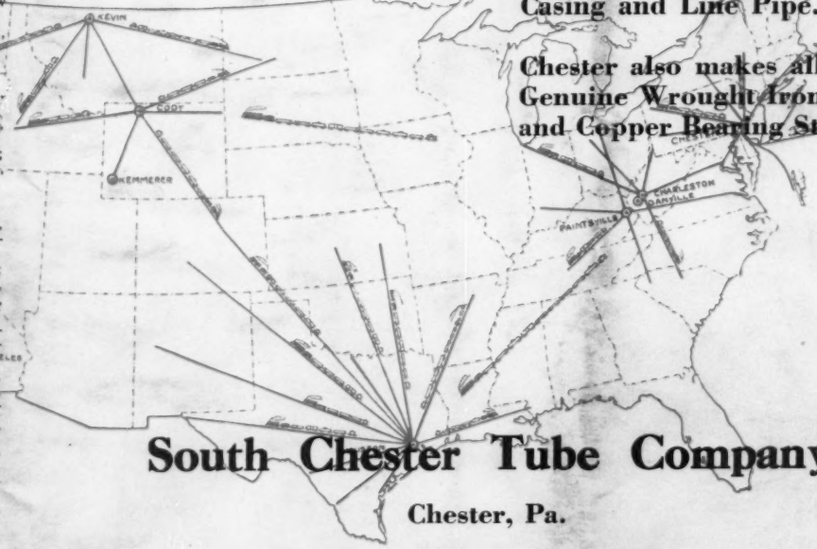

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